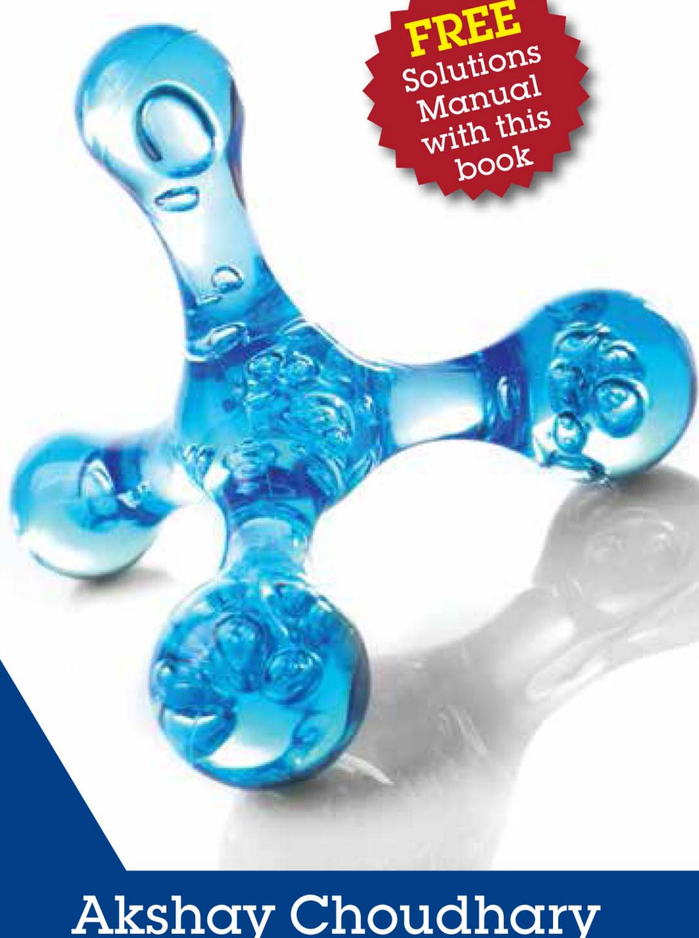
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Contents

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Preface

In order to understand a subject, it is important to gain an insight into its guiding principles and proof of concept. Theory is beneficial only when it can be successfully applied to solve problems. This book presents different types of problems to exemplify each and every theoretical discussion to help the student gain a masterly grasp of the subject. As the saying goes, 'Practice makes a man perfect', so we set forth in this practice book a multitude of problems to acquaint the student with the different types of questions that could be posed in the subject.

This book includes all levels of problems in organic chemistry that every JEE aspirant needs to be skilled at solving. We hope this book helps students to achieve their target.
Readers may send their suggestions to akshaymandakini24@gmail.com.

Akshay Choudhary
Mandakini Choudhary

Acknowledgements

The editorial team at Pearson Education has been pivotal in encouraging this project, while my wife has very ably and diligently done the proof-reading of the complete manuscript. I am indebted to my family members Om Prakash Choudhary, Sita Devi, Hemant Choudhary, Kamla Choudhary, Shivani Choudhary, Ravindra Choudhary, and my uncle Shyam Lal Choudhary who have played a prime role in making me more focused. I am grateful to my daughter Sagarika and son Aatish whose joyful faces give me the patience to work.

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Suggestions for improving the book's contents, queries, and criticisms are always welcome.

Akshay Choudhary

About the Authors



Akshay Choudhary, a renowned faculty of organic chemistry, teaches IIT-JEE aspirants, assisting them to achieve their goal. Many students have been successful under his guidance and achieved top ranks in the IIT–JEE exam. The author is a postgraduate in chemistry as well as Junior Research Fellow from NCL, Pune.

His has keen interest in the subject and strives to present it to students in a lucid style to help them ace the exams effortlessly.

Mandakini Choudhary, specializes in reaction mechanisms and intermediates. She is a dedicated teacher with four years' experience and is popular among students for her zeal to help them with their board examinations.

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CHAPTER 1

General Organic Chemistry

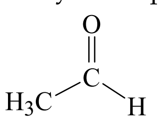
Question Bank

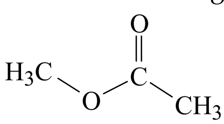
LEVEL 1

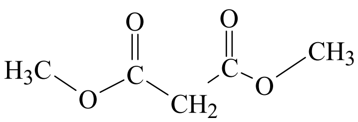
Arrange the items in Questions 1–38 in **DECREASING ORDER** (i.e., greatest, most etc. first) with respect to the indicated property.

Use the following code to indicate your answers.

1. The acidity of the protons H in each of the following is

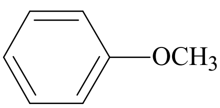
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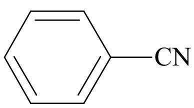
(ii) 

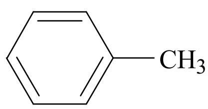
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

2. Rate of reaction of HNO_3/H_2SO_4 with each of the following is

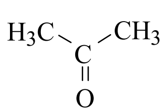
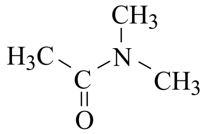
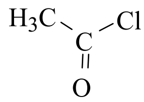
(i) 

(ii) 

(iii) 

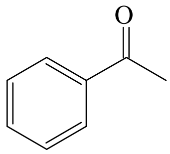
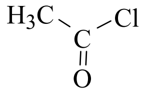
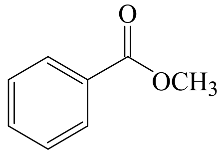
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

3. Reactivity towards hydrolysis using aqueous acid of the following is

(i)  (ii)  (iii) 

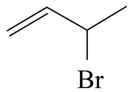
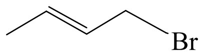
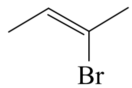
(a) i > ii > iii (b) iii > ii > i (c) i > iii > ii (d) iii > i > ii

4. Reactivity of the following towards reaction with $LiAlH_4$ is

(i)  (ii)  (iii) 

(a) ii > i > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i> ii

5. The relative yield of the following alkenyl bromides from the reaction of 1,3-butadiene with HBr (dark, N_2 atmosphere) at –15°C is

(i)  (ii)  (iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

6. The amount of conjugate addition obtained in the reaction of the following with 3-butenone is

(i) CH_3Li (ii) CH_3MgBr (iii) $CH_3O_2C-\bar{C}H-CO_2CH_3$

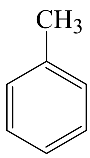
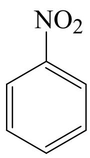
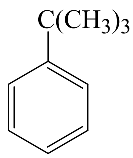
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

7. The relative reactivity towards Br_2 in $CHCl_3$ of the following is

(i) $CH_2{=}CH{-}CO_2CH_3$ (ii) $CH_2{=}CH{-}CH_3$ (iii) $CH_2{=}CH{-}O{-}CH_3$

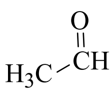
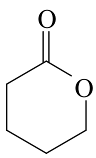
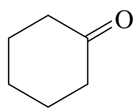
(a) i > ii > iii (b) iii > ii > i (c) i > iii > ii (d) iii > i > ii

8. The % of the para product produced in the reaction of $Br_2/FeBr_3$ with each of the following is

(i)  (ii)  (iii) 

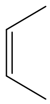
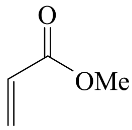
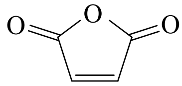
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

9. The number of enolizable protons in each of the following is

(i)  (ii)  (iii) 

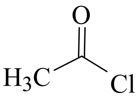
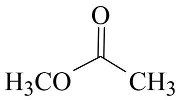
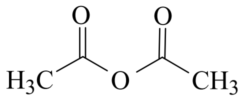
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

10. The relative reactivity towards 1,3-cyclopentadiene of each of the following is

(i)  (ii)  (iii) 

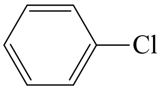
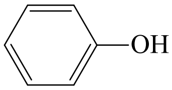
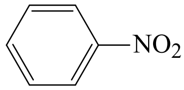
(a) iii > ii > i (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

11. The relative rate of hydrolysis using dilute aq. NaOH of the following is

(i)  (ii)  (iii) 

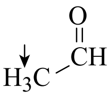
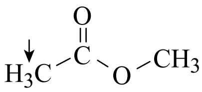
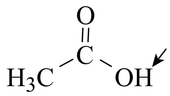
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

12. The relative rate of reaction of isopropyl chloride/$AlCl_3$ with each of the following is

(i)  (ii)  (iii) 

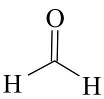
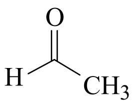
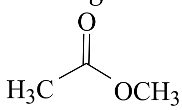
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) ii > i > iii

13. The relative acidity of the indicated H in each of the following is

(i)  (ii)  (iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

14. The relative reactivity towards reaction with MeMgBr of the following is

(i)  (ii)  (iii) 

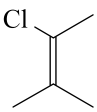
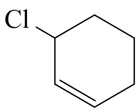
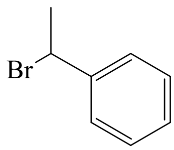
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

15. The relative nucleophilicity in polar, protic solvents of the following is

(i) $CH_3CH_2S^-$ (ii) $CH_3CH_2O^-$ (iii) $CH_3CO_2^-$

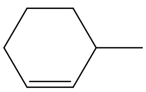
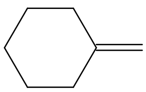
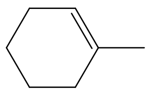
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

16. The relative rate of reaction with aq. EtOH/$AgNO_3$ of the following is

(i)  (ii)  (iii) 

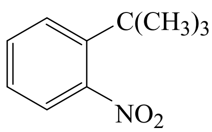
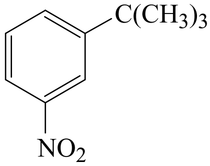
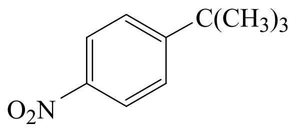
(a) i > ii > iii (b) iii > ii > i (c) i > iii > ii (d) iii > i > ii

17. The relative yield of the following products produced by the reaction of conc. H_2SO_4 with 1-methylcyclohexanol is

(i)  (ii)  (iii) 

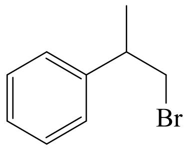
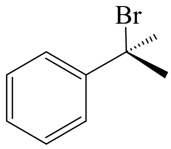
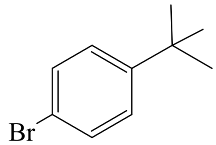
(a) i > ii > iii (b) ii > iii > i (c) iii > ii > i (d) iii > i > ii

18. The relative yield of the following products produced in the nitration reaction of t-butylbenzene is

(i)  (ii)  (iii) 

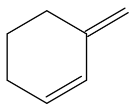
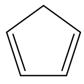
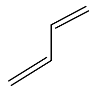
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

19. The relative yield of the following products produced by the reaction of isopropyl benzene with Br_2/UV light is

(i)  (ii)  (iii) 

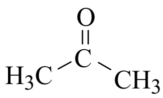
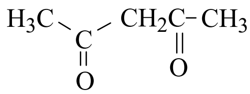
(a) i > ii > iii (b) ii > i > iii (c) i > iii > ii (d) iii > i > ii

20. The relative reactivity towards dimethyl cis-butendioate (also called dimethyl maleate) of the following is

(i)  (ii)  (iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

21. The acidity of the protons H in each of the following is

(i)  (ii)  (iii) CH_3COOH

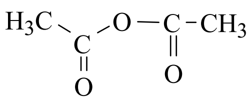
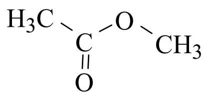
(a) iii > ii > i (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

22. The relative nucleophilicity in polar protic solvents of each of the following is

(i) CH_3OH (ii) CH_3SH (iii) CH_3NH_2

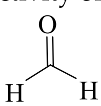
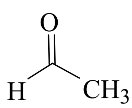
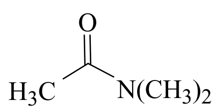
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

23. Reactivity towards NH_3 of each of the following is

(i)  (ii)  (iii) CH_3COCl

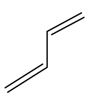
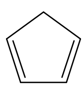
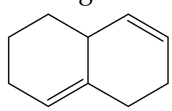
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

24. Reactivity of the following towards reaction with $NaBH_4$ is

(i)  (ii)  (iii) 

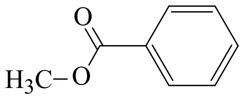
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

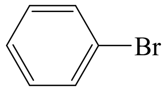
25. The relative reactivity towards 1-buten-3-one of each of the following is

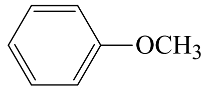
(i)  (ii)  (iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) ii > i > iii

26. Rate of reaction of $CH_3COCl/AlCl_3$ with each of the following is

(i) 

(ii) 

(iii) 

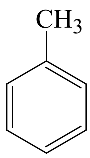
(a) iii > ii > i (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

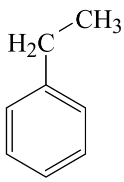
27. The relative stability of the following radicals is

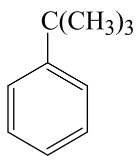
(i) $CH_3CH = CH-\dot{C}H_2$ (ii) $\dot{C}H = CHCH_3$ (iii) $CH_3\dot{C}HCH_3$

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

28. The ortho/para product ratio produced in the reaction of $Br_2/FeBr_3$ with each of the following is

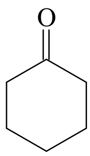
(i) 

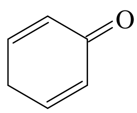
(ii) 

(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

29. The amount of the enol form present at equilibrium for each of the following is

(i) $(CH_3)_3CCOH$ (ii) 

(iii) 

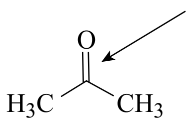
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > ii > i

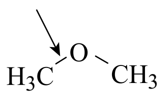
30. The relative yield of the following alkenes produced by the reaction of trans-1-chloro-2-methylcyclohexane with KOH/heat is

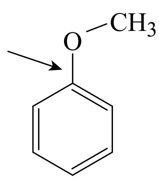
(i) 1-methylcyclohexene (ii) methylenecyclohexane
(iii) 3-methylcyclohexene

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

31. Identify correct C–O bond length order

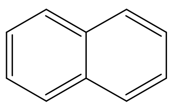
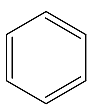
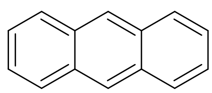
(i) 

(ii) 

(iii) 

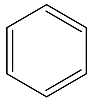
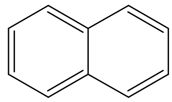
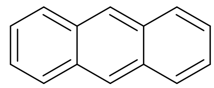
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

32. The resonance energy of each of the following is

(i) 
(ii) 
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

33. Identify order of per ring resonance energies of each of the following

(i)  (ii)  (iii) 

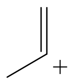
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > ii > i

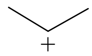
34. Identify the correct boiling point order of each of the following

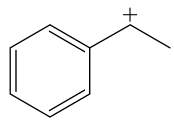
(i) CH_3CH_3 (ii) $CH_3CH_2CH_2CH_3$ (iii) $(CH_3)_3CH$

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > ii > i

35. The relative stability of the following carbocations is

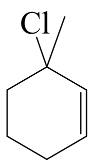
(i) 

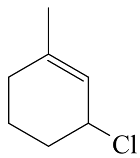
(ii) 

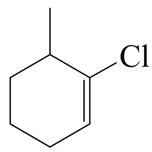
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > ii > i

36. The relative yield of the following products from the reaction of HCl with 1-methyl-1, 3-cyclohexadiene at 50ºC is

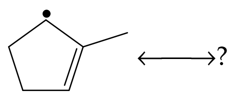
(i) 

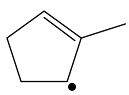
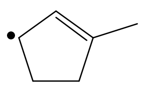
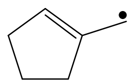
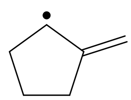
(ii) 

(iii) 

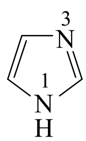
(a) i > ii > iii (b) ii > i > iii (c) i > iii > ii (d) iii > ii > i

37. Which of the following systems are resonance contributors of the radical shown below? (select all that apply)



(a)  (b)  (c)  (d) 

38. Imidazole has a pKa = 7 with respect to its conjugate acid. Which N is protonated in this conjugate acid and why?

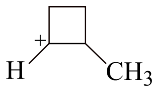
imidazole 

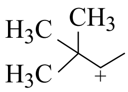
(a) N1 because imidazole is an aromatic heterocycle where $n = 1$ as per Huckel's rule.
(b) N1 is protonated because it is sp^3 hybridised.
(c) N3 is protonated because it is sp^2 hybridised.
(d) N1 is protonated because the lone pair is part of the aromatic pi system.

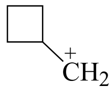
39. Cyclopentadiene has a pKa = 15, whereas cyclopentane has a pKa > 50. This is because
(a) Cyclopentadiene is particularly unstable.
(b) Cyclopentane contains no lone pairs.
(c) Cyclopentadiene is a 4π anti-aromatic compound.
(d) Cyclopentadiene is a 4π non-aromatic compound and after deprotonation it is aromatic.

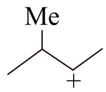
40. The α-hydrogens of esters typically have a pKa = 25, whereas for ketones pKa = 20. This is because:
(a) There is no resonance stabilisation of the enolates of esters.
(b) The inductive effect of the oxygen in the ester destabilises the ester enolate.
(c) The electron donating alkoxy group in esters destabilises the enolate.
(d) The electron donating alkoxy group in esters stabilises the enolate.

41. Which of the following is most likely to undergo a favorable hydride shift?

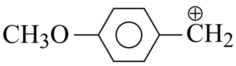
(a) 

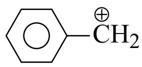
(b) 

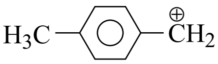
(c) 

(d) 

42. Relative stabilities of the following carbocations will be in the order

(i) 

(ii) 

(iii) 

(iv) $CH_3\overset{\oplus}{C}H_2$

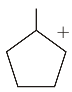
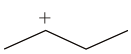
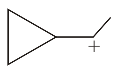
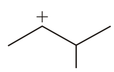
(a) i < ii < iii < iv
(b) iv < iii < ii < i
(c) iv < ii < iii < i
(d) ii < iv < iii < i

43. Which of the following forms most stable carbocation upon removal of OH^-?
(a) $(CH_3)_3C-CH_2OH$
(b) $CH_3CH_2CH_2CH_2OH$
(c) $C_6H_5CH_2OH$
(d) $C_6H_5CH_2CH_2OH$

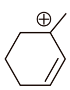
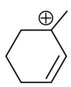
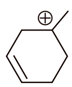
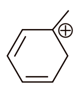
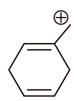
44. Which of the following carbonium ion is most stable?

(a) $CH_3-\overset{CH_3}{\underset{CH_3}{C^{\oplus}}}$
(b) $C_2H_5-\overset{C_2H_5}{\underset{C_2H_5}{C^{\oplus}}}$
(c) $CH_3-\overset{CH_3}{\underset{H}{C^{\oplus}}}$
(d) $C_2H_5-\overset{C_2H_5}{\underset{H}{C^{\oplus}}}$

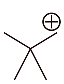
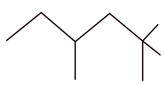
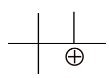
45. Which of the following carbocations would not likely rearrange to a more stable carbocation?

(a) 
(b) 
(c) 
(d) 

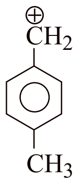
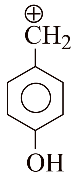
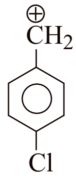
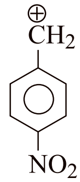
46. Which carbocation is the most stabilised?

(a) 
(b) 
(c) 
(d) 
(e) 

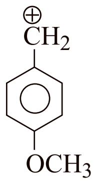
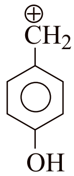
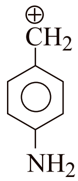
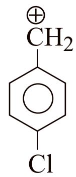
47. Which of the following carbocation do rearrange?

(a) 
(b) $CH_3-\overset{\oplus}{C}=CH_2$
(c) 
(d) 

48. Which carbocation is the most stable?

(a)  (b)  (c)  (d) 

49. Arrange stability of the given carbocations in decreasing order

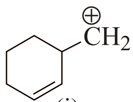
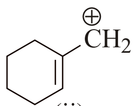
(i)  (ii)  (iii)  (iv) 

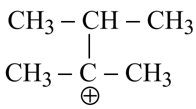
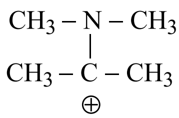
(a) iii > ii > i > iv
(b) i > ii > iii > iv
(c) iii > i > ii > iv
(d) ii > iii > i > iv

50. In each of the following pairs of ions, which ion is more stable?

(a) $\underset{\text{(i)}}{C_6H_5-\overset{\oplus}{C}H_2}$ and $\underset{\text{(ii)}}{CH_2=CH-\overset{\oplus}{C}H_2}$

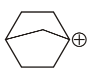
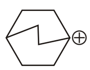
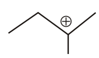
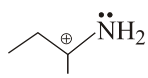
(b) $\underset{\text{(i)}}{CH_3-\overset{\oplus}{C}H_2}$ and $\underset{\text{(ii)}}{CH_2=\overset{\oplus}{C}H}$

(c)  (i) and  (ii)

(d)  (i) and  (ii)

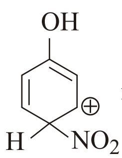
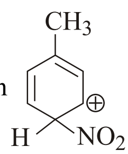
(a) a–i, b–i, c–ii, d–ii
(b) a–ii, b–ii, c–ii, d–ii
(c) a–i, b–i, c–i, d–i
(d) a–ii, b–ii, c–i, d–i

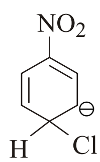
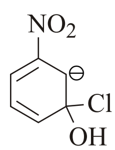
51. Which of the following two carbonium ions is more stable? Explain why.

(a)  (I)  (II) (b)  (I)  (II)

(a) a–ii, b–ii (b) a–i, b–i (c) a–i, b–ii (d) a–ii, b–i

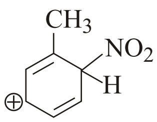
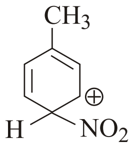
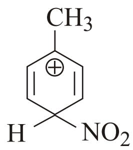
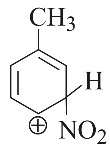
52. Consider the following statements:

(i)  is more stable than 

(ii)  is more stable than 

(a) i and ii both are correct
(b) i and reverse of ii are correct
(c) ii and reverse of i are correct
(d) i and ii both are incorrect

53. Which is the most stable arenium carbocation?

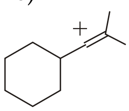
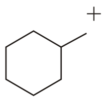
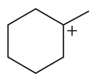
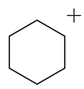
(a)  (b)  (c)  (d) 

54. $CD_3-\overset{\displaystyle CD_3}{\underset{\oplus}{C}}-CD_3$ (I) $\qquad CH_3-\overset{\displaystyle CH_3}{\underset{\oplus}{C}}-CH_3$ (II)

Which of the following statements is correct?

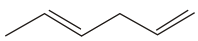
(a) i is more stable than ii
(b) ii is more stable than i
(c) Both are equally stable
(d) Stability criterion cannot be applied in this case

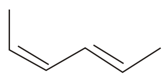
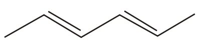
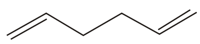
55. List the following carbocations in order of decreasing stability (starting with the most stable)

(i)  (ii)  (iii)  (iv) 

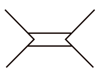
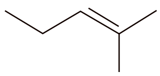
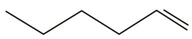
(a) ii, iii, i, iv
(b) iii, iv, ii, i
(c) iii, iv, i, ii
(d) i, ii, iv, iii

56. Under thermodynamic control, which of the following products would predominate?

 $\xrightarrow{\text{H}^+ \text{ and then deprotonate}}$

(a) 
(b) 
(c) 
(d) 

57. Rank the following in order of stability (lowest to highest)

(i) 
(ii) 
(iii) 
(iv) 

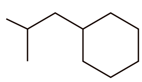
(a) iv < ii < iii < i
(b) iv < iii < ii < i
(c) i < iii < ii < iv
(d) iv < ii = iii < i

58. Rank, from the most stabilised to the least stabilised, the following free radicals according to their stabilisation energies.

(i) $CH_3\dot{C}H_2$
(ii) $\dot{C}H_2CH_3$
(iii) $(CH_3)_2\dot{C}H$
(iv) $(CH_2=CH-\dot{C}H_2)$

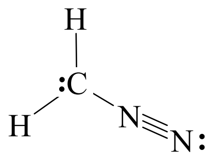
(a) iv > iii > ii > i
(b) i > iv > iii > ii
(c) iii > iv > i > ii
(d) iii > iv > ii > i

59. How many tertiary hydrogen(s) are (is) there in the following structure?



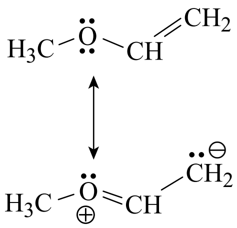
(a) 1
(b) 2
(c) 3
(d) 6

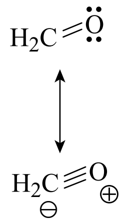
60. For the following incomplete Lewis structure, what are the correct formal charges for the carbon and the nitrogen attached to the carbon?

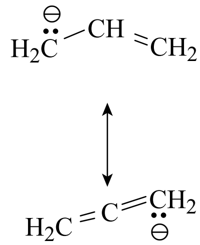


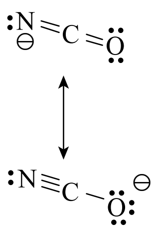
(a) C:0, N:0 (b) C:–1, N:0 (c) C:–1, N:+1 (d) C:+1, N:–1

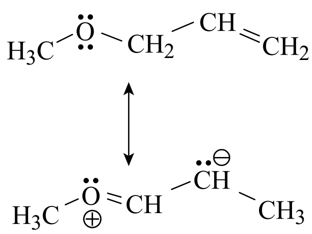
61. Which of the following are pairs of resonance structures?

(i) 

(ii) 

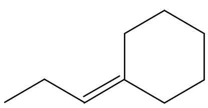
(iii) 

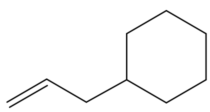
(iv) 

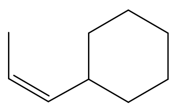
(v) 

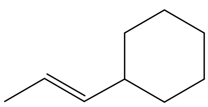
(a) i, ii, iii (b) i, iv (c) ii, iv, v (d) i, iii, iv

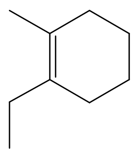
62. Arrange the following alkenes in order of their stability (most to the least).

(i) 

(ii) 

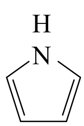
(iii) 

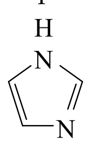
(iv) 

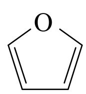
(v) 

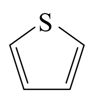
(a) v > ii > iii > iv > i (b) v > ii > iv > iii > i
(c) v > ii > iii > i > iv (d) v > i > iv > iii > ii

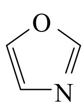
63. Which of the following compounds are aromatic compounds?

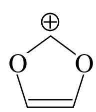
(i) 

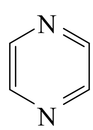
(ii) 

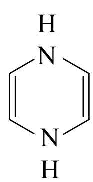
(iii) 

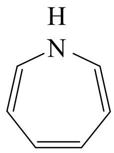
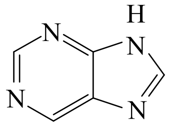
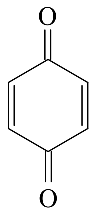
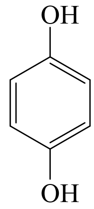
(iv) 

(v) 

(vi) 

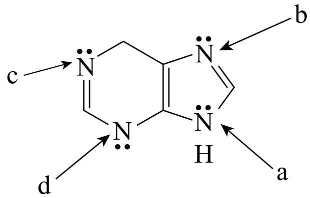
(vii) 

(viii) 

(ix)  (x)  (xi)  (xii) 

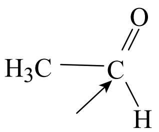
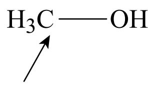
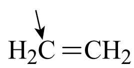
(a) i, ii, iii, iv, v, vi, viii, x, xii
(b) i, ii, iii, vi, viii, x, xi, xii
(c) i, ii, iii, iv, v, vi, vii, x, xii
(d) i, ii, iii, v, vii, viii, ix, x, xii

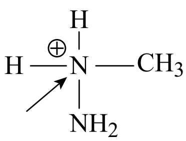
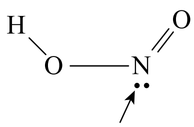
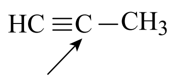
64. For the following compounds, which nitrogen is the least tendency to be protonated?

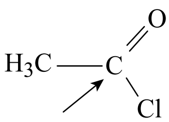
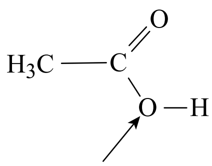


(a) Nitrogen indicated by arrow "b"
(b) Nitrogen indicated by arrow "a"
(c) Nitrogen indicated by arrow "c"
(d) Nitrogen indicated by arrow "d"

65. Using the VSEPR model, predict which atoms pointed by an arrow have SP² hybridisation. (Note: not all the lone pair electrons are displayed)

(i)  (ii)  (iii) 

(iv)  (v)  (vi) 

(vii)  (viii) 

(a) i, ii, iv, viii (b) i, iii, v, vii (c) ii, iii, v, vii (d) ii, iv, v, viii

66. Arrange the following compounds in order of their acidity. (most to least)
(i) CH_3CH_2OH (ii) CFH_2CO_2H (iii) CF_2HCO_2H
(iv) CF_3COOH (v) CH_3CO_2H

(a) iv > iii > ii > v > i
(b) iv > iii > ii > i > v
(c) v > ii > iii > iv > i
(d) v > iii > iv > ii > i

67. Rank the following intermediates according to the stability (most stable first). Explain your choices.

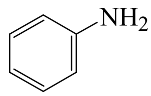
(a) $CH_3CH_2CH_2\overset{\oplus}{C}H_2$, $CH_3\overset{\oplus}{C}HCH_2CH_3$, $(CH_3)_2\overset{\oplus}{C}CH_2CH_3$, $(CH_3)_3\overset{\oplus}{C}$

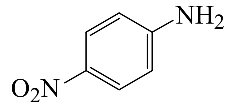
(b) $CH_3CH_2CH_2\dot{C}H_2$, $CH_3\dot{C}HCH_2CH_3$, $(CH_3)_2\dot{C}CH_2CH_3$, $(CH_3)_3\dot{C}$

(c) $CH_3CH_2CH_2\overset{\ominus}{C}H_2$, $CH_3\overset{\ominus}{C}HCH_2CH_3$, $(CH_3)_2\overset{\ominus}{C}CH_2CH_3$

(d) CH_2:, CH_2CH:, C_6H_5CH:, $(C_6H_5)_2C$:

68. Which of the following base has the most acidic conjugate acid?

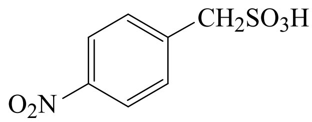
(i) NH_3 (ii) $CH_3CH_2NH_2$ (iii) 

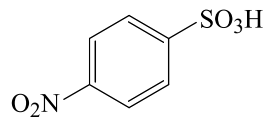
(iv) 

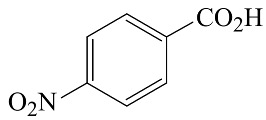
pKb 4.74 3.19 9.37 13.0

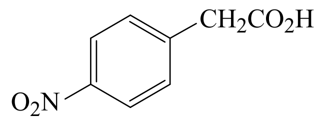
(a) i (b) ii (c) iii (d) iv

69. What is the structure of p-nitrobenzenesulfonic acid?

(a) 

(b) 

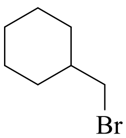
(c) 

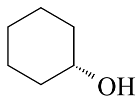
(d) 

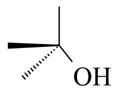
70. Which of the following compound has the highest boiling point?

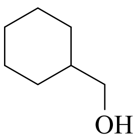
(a) CH_3OCH_3 (b) CH_3COCH_3 (c) CH_3CH_2OH (d) CH_3CO_2H

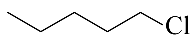
71. Which are secondary alkyl alcohols among the following?

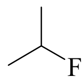
(i) 

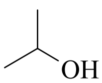
(ii) 

(iii) 

(iv) 

(v) 

(vi) 

(vii) 

(viii) CH_3OH (ix) CH_3CH_2I

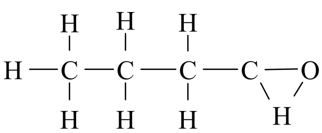
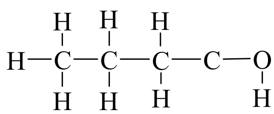
(a) vii (b) ii, iv, vi (c) i, vi, x (d) ii, vii

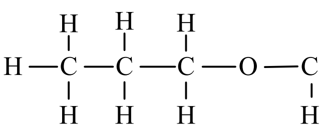
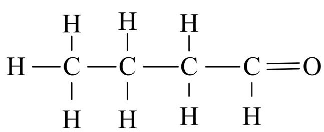
72. Which is the electronic configuration that describes Na^+?

(a) $1S^2, 2S^2, 2P^6$ (b) $1S^2, 2S^2, 2P^6, 3S^2, 3P^6$

(c) $1S^2, 2S^2$ (d) $1S^2, 2S^2, 2P^6, 3S^2$

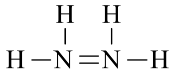
73. What is the Lewis structure of $CH_3 - CH_2 - CH_2 - CHO$?

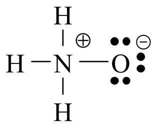
(a) 
(b) 

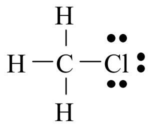
(c) 
(d) 

74. Which Lewis structure(s) is(are) correct?

(i) $H-O\equiv O-H$

(ii) 

(iii) 

(iv) 

(a) i, ii (b) ii, iv (c) iii, iv (d) i, iii

75. Which molecules are non-polar?

(i) NH_3 (ii) CO_2 (iii) H_2O

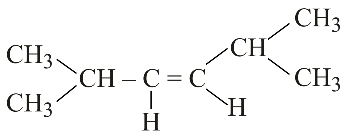
(iv) CF_4 (v) Br_2 (vi) BF_3

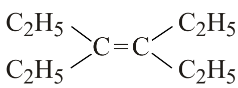
(vii) CH_2Cl_2 (viii) H_2O_2

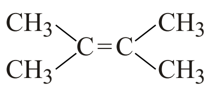
(a) ii, iv, v, vi (b) i, iv, vi, viii

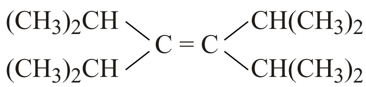
(c) iii, iv, v, vi (d) i, iii, vii, viii

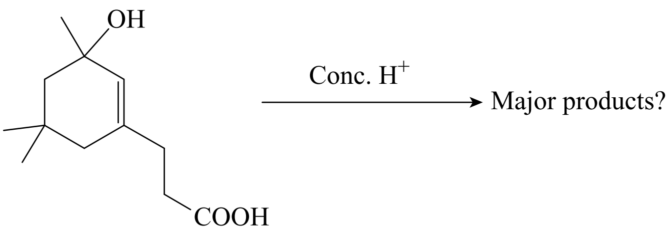
76. Which of the following is the most stable alkene?

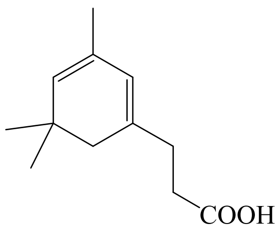
(a) 

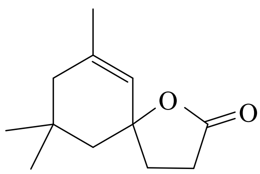
(b) 

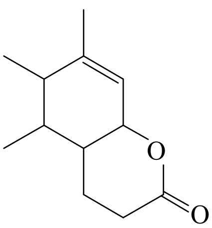
(c) 

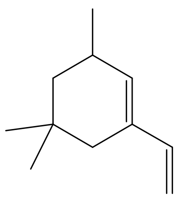
(d) 

77. 

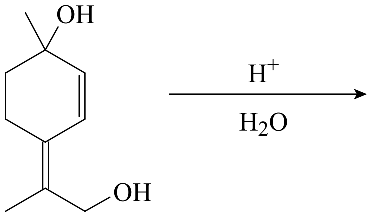
(a) 

(b) 

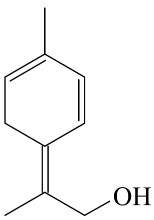
(c) 

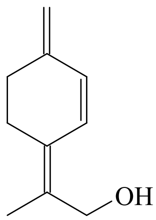
(d) 

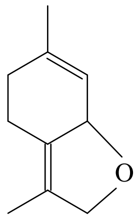
78. Hyperconjugation is best described as:
(a) delocalisation of p electrons into a nearby empty orbital
(b) delocalisation of σ electrons into a nearby empty orbital
(c) the effect of alkyl groups donating a small amount of electron density inductively into a carbocation
(d) the migration of a carbon or hydrogen from one carbocation to another

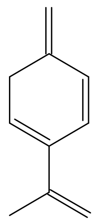
79. 

Major product is?

(a) 

(b) 

(c) 

(d) 

80. Which of the following statements best explains why 1-propyne can be deprotonated by the ethyl anion ($CH_3CH_2^-$)?
(a) The acetylide anion is a stronger base than the ethyl anion.
(b) Ethane has a lower pK_a than acetylene.
(c) The lone-pair orbitals in acetylide anions have more s character than those in alkyl anions.
(d) The acetylide anion is a weaker base than an alkyl anion.

81. Which of the following statements is NOT true for ethylene ($CH_2 = CH_2$) molecule?
(a) Both carbons are sp^2 hybridised.
(b) C = C bond length is shorter than the C–C bond length in ethane.
(c) The two C = C bonds are equally strong. (one is pi and the other is sigma.)
(d) The entire molecule has a planar geometry.

82. Which of the following is the product of the reaction between $AlCl_3$ and CH_3OCH_3?

(a) $Cl-\overset{Cl}{\underset{Cl}{\overset{-}{Al}}}-\overset{+}{O}(CH_3)_2$ (b) $Cl-\overset{Cl}{\underset{Cl}{\overset{+}{Al}}}-\overset{-}{O}(CH_3)_2$

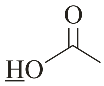
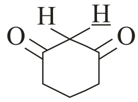
(c) $Cl-\overset{Cl}{\underset{Cl}{\overset{+}{Al}}}-\overset{+}{O}(CH_3)_2$ (d) $Cl-\overset{Cl}{\underset{Cl}{\overset{-}{Al}}}-\overset{+}{C}H_3OCH_3$

83. The acidity for the following compounds increases in the order

(i) $CH_3CH_2CH_2CO_2H$ (ii) $CH_3CH_2\underset{|}{\overset{Cl}{C}}HCO_2H$ (iii) $CH_3CH_2CH_2CH_2OH$

(a) i < ii < iii (b) ii < iii < i (c) iii < i < ii (d) ii < i < iii

84. The relative acidity of the underlined H in each of the following is in the order

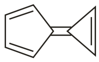
(i)  (ii)  (iii) $CH_3{-}C{\equiv}C{-}\underline{H}$

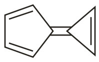
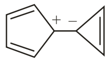
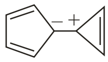
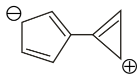
(a) i > ii > iii (b) i > iii > ii (c) ii > i > iii (d) ii > iii > i

85. Which of the underlined atoms in the molecules shown below have sp hybridisation?

(a) $\underline{C}H_2CHCH_3$ (b) $CH_2\underline{C}CHCl$ (c) $CH_3\underline{C}H_2^+$
(d) $H\underline{C}CCH_3$ (e) $CH_3\underline{C}N$ (f) $(CH_3)_2C\underline{N}NH_2$

(a) d and f (b) d, e and f (c) a, c and d (d) b, d and e

86. A compound  shows a large dipole moment. Which of the following resonance structures can be used to adequately explain this observation?

(i)  (ii)  (iii)  (iv) 

(a) i (b) iii and iv (c) ii and iii (d) iv only

87. The nitrogen in trimethylamine is

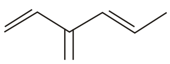
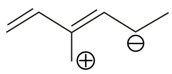
(a) sp^2 hybridised (b) sp^3 hybridised
(c) sp hybridised (d) sp^3d^2 hybridised

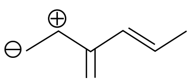
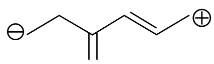
88. The acidity of the protons $\underline{H}$:

(i) $CH_3CH_2\overset{O}{\overset{\|}{C}}C\underline{H}_3$ (ii) $CH_3CH_2O\overset{O}{\overset{\|}{C}}C\underline{H}_3$ (iii) $CH_3CH_2O\overset{O}{\overset{\|}{C}}C\underline{H}_2\overset{O}{\overset{\|}{C}}OCH_2CH_3$

(a) i > ii > iii (b) i > iii > ii (c) ii > i > iii (d) iii > i > ii

89. Which of the following is not a valid resonance structure of the others?

(a)  (b) 

(c)  (d) 

90. Which is(are) the correct orbital hybridisation (s) for the C and N atoms in the following structures?

(i) CH_3CH_3 sp^3 (ii) $CH_2{=}CH_2$ sp (iii) NH_3 sp^2 (iv) $HC{\equiv}CH$ sp^2

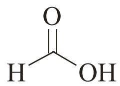
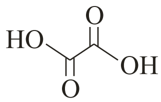
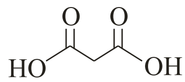
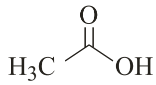
(a) i (b) ii, iii (c) iii, iv (d) i, iii

91. Which allylic carbocation is the most stable carbocation?

(a) $CH_3-CH=CH-\overset{\oplus}{C}H_2$ (b) $CH_3-CH=CH-\overset{\oplus}{C}H-CH_3$

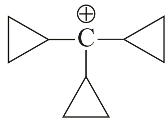
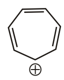
(c) $CH_3-CH=CH-\overset{\oplus}{C}(CH_3)-CH_3$ (d) All have same stability

92. Rank the following molecules in order of decreasing acidity (increasing pK_a)

(i)  (ii)  (iii)  (iv) 

(a) ii > iii > i > iv
(b) iii > ii > i > iv
(c) i > iv > ii > iii
(d) iv > iii > i > ii

93. Which among the following carbocations is most stable?

(a) 
(b) $C_6H_5-\overset{\oplus}{C}H_2$
(c) 
(d) $CH_3-\overset{\oplus}{C}H-CH_3$

94. Which of the following statements about resonance structures is false?
(a) Individual resonance structures are imaginary, not real.
(b) Resonance forms differ only in the placement of their π- or non-bonding electrons or unpaired electron.
(c) Different resonance structures of a substance do not have to be equivalent.
(d) In valid resonance structures, all atoms from the second row of the periodic table must have an octet of electrons.

LEVEL 2

Single and Multiple-choice Type

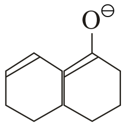
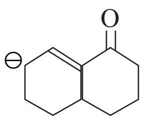
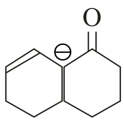
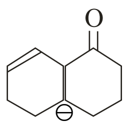
1. The strength of the following bases decreases in the order

(i) $CH_3O^{\ominus}$ (ii) $CH_3^{\ominus}$ (iii) $NH_2^{\ominus}$ (iv) $CH_3C(=O)-O^{\ominus}$

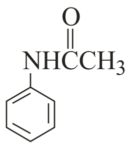
(a) i > iv > iii > ii (b) iii > iv > i > ii

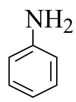
(c) ii > iii > i > iv (d) iv > i > ii > iii

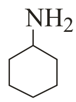
2. Which of the following is not a resonance structure of the others?

(a) 
(b) 
(c) 
(d) 

3. Rank of the following three compounds in decreasing order of basicity is

(i) 

(ii) 

(iii) 

(a) iii > i > ii (b) iii > ii > i (c) ii > i > iii (d) ii > iii > i

4. Compare the hybridisation of the central carbon atoms in carbon dioxide (CO_2) and allene ($H_2C=C=CH_2$). Which statement is correct?

(a) The hybridisation types of these two carbons cannot be compared because of large electronegativity difference between carbon and oxygen in CO_2 that does not exist in allene.

(b) The hybridisation of carbon in CO_2 cannot be determined, because the lone electron pairs on oxygen do not allow for angle measurements that are necessary to determine the hybridisation involved.

(c) In CO_2 the carbon is sp^2 hybridised, but in allene the central carbon is sp hybridised.

(d) In CO_2 the carbon is sp hybridised but in allene the central carbon is sp hybridised.

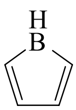
5. The strength of the following bases decreases in the order

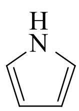
(i) $Br^{\ominus}$ (ii) $F^{\ominus}$ (iii) $NH_2^{\ominus}$ (iv) $CH_3^{\ominus}$

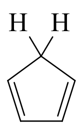
(a) iv > iii > ii > i (b) iii > iv > i > ii

(c) ii > i > iii > iv (d) iv > i > ii > iii

6. Choose the following species that would be predicted to be aromatic according to Hückel's rule.

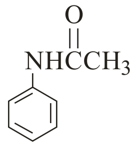
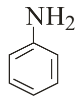
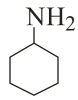
(i) 

(ii) 

(iii) 

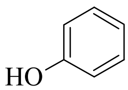
(a) i (b) ii (c) iii (d) i and ii

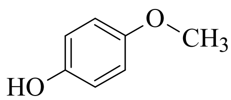
7. Rank of the following three compounds in decreasing order of basicity is

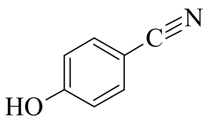
(i)  (ii)  (iii) 

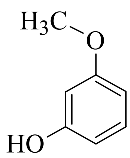
(a) iii > i > ii (b) iii > ii > i (c) ii > i > iii (d) ii > iii > i

8. Which of the following phenol would be the most acidic?

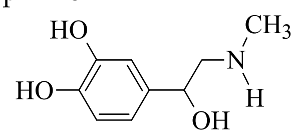
(a) 

(b) 

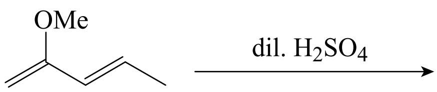
(c) 

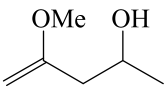
(d) 

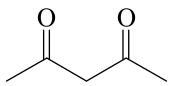
9. Choose the correct formula for epinephrine.

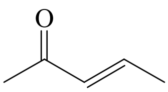


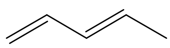
(a) $C_{10}H_{13}NO_3$ (b) $C_9H_{12}NO_3$ (c) $C_{10}H_{14}NO_3$ (d) $C_9H_{13}NO_3$

10.  Major product is?

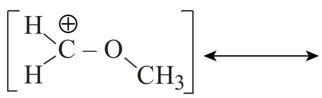
(a) 

(b) 

(c) 

(d) 

11. Which is an acceptable resonance structure for the following drawing?



(a) $CH_3\overset{\oplus}{C}H-OH$

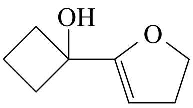
(b) $CH_2=\overset{\oplus}{O}-CH_3$

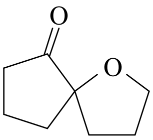
(c) $CH_2CH_2\overset{\oplus}{O}$

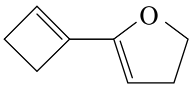
(d) $CH_3CH=\overset{\oplus}{O}H$

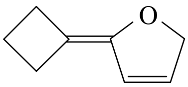
12. In allene ($H_2C=C=CH_2$), the terminal carbons are sp^2 hybridised. Each of the two terminal H_2C groups are situated in such a manner that the two "terminal" planes are 90° from each other. Other compounds with double bonds on successive carbons may also exist. They are called cumulenes. What is the relationship between the two terminal H_2C groups in a cumulene containing three consecutive double bonds ($H_2C=C=C=CH_2$)?

(a) They are in perpendicular planes.
(b) They are in two planes 60° from each other.
(c) They are in the same plane.
(d) They are in two planes 120° from each other.

13.  $\xrightarrow{\text{Conc. } H_2SO_4}$ Product is ?

(a) 

(b) 

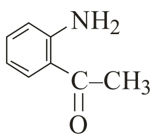
(c) 

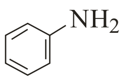
(d) None of these

14. Alkyne hydrogens are more acidic than alkene or alkane hydrogens because
(a) The alkyne carbon has higher 's' character.
(b) The anion formed is more stable.
(c) The electrons in the sp orbital are closer to the nucleus.
(d) All of the above.

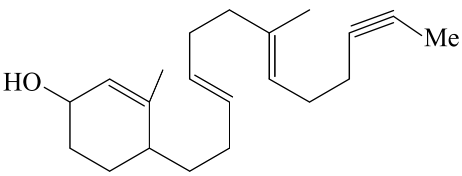
15. Which of the following is expected to be the least basic?

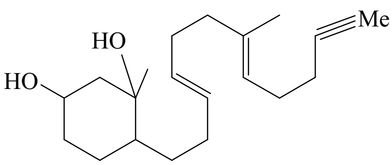
(a) $CH_3CH_2CH_2NH_2$

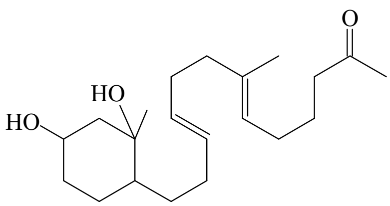
(b) 

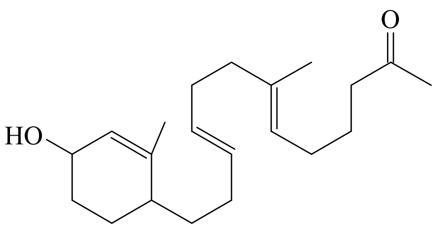
(c) 

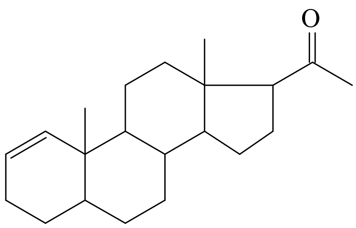
(d) $(CH_3)_3N$

16.  $\xrightarrow{\text{dil. } H_2SO_4}$ Major product is?

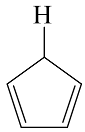
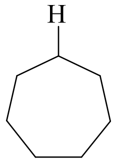
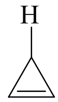
(a) 

(b) 

(c) 

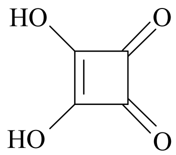
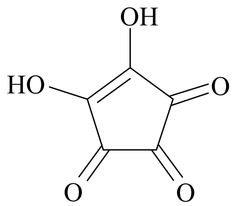
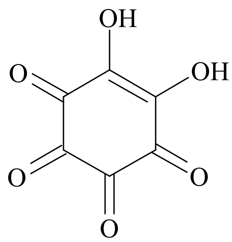
(d) 

17. The acidity of the protons H in each of the following is

(i)  (ii)  (iii) 

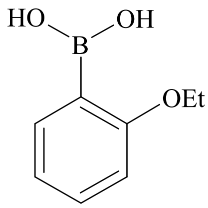
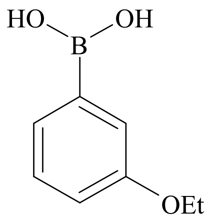
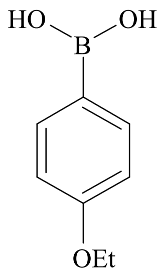
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

18. The acidity of the protons H in each of the following is

(i)  (ii)  (iii) 

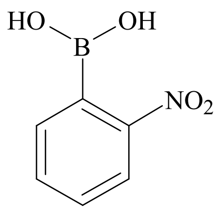
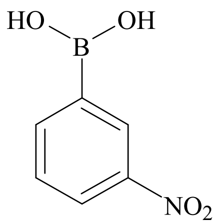
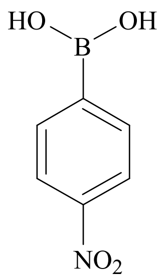
(a) i > ii > iii (b) iii > ii > i (c) i > iii > ii (d) iii > i > ii

19. Identify correct acidic strength order in the following compounds

(i)  (ii)  (iii) 

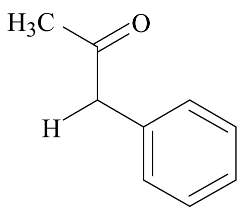
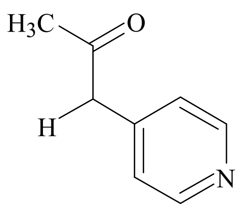
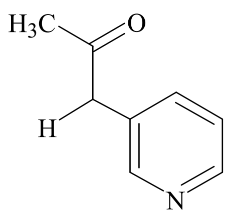
(a) i > ii > iii (b) ii > iii > i (c) ii > i > iii (d) iii > i > ii

20. Identify correct acidic strength order in the following compounds

(i)  (ii)  (iii) 

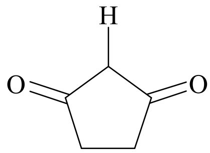
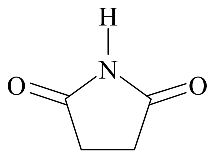
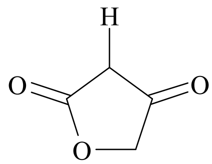
(a) i > ii > iii (b) iii > ii > i (c) i > iii > ii (d) iii > i > ii

21. Identify correct acidic strength order in the following compounds

(i)  (ii)  (iii) 

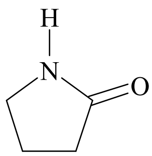
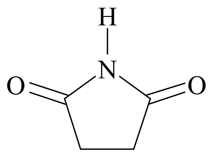
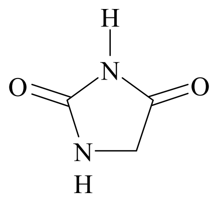
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

22. Identify correct acidic strength order in the following compounds

(i)  (ii)  (iii) 

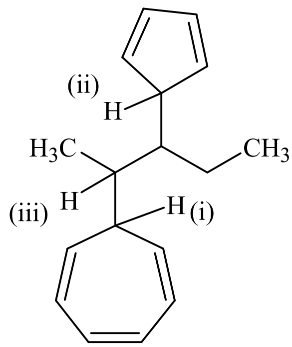
(a) ii > i > iii
(b) ii > iii > i
(c) i > iii > ii
(d) iii > i > ii

23. Identify correct acidic strength order in the following compounds

(i)  (ii)  (iii) 

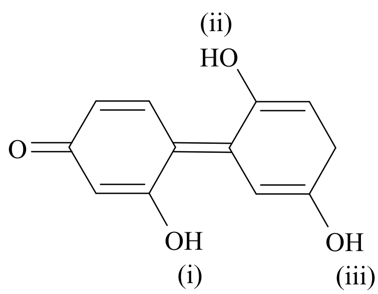
(a) i > ii > iii
(b) ii > iii > i
(c) i > iii > ii
(d) iii > i > ii

24. Identify correct acidic strength order in the following compounds



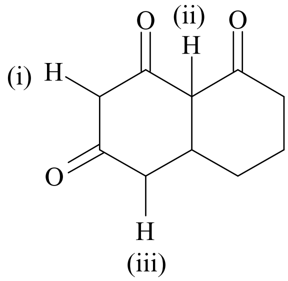
(a) i > ii > iii
(b) ii > iii > i
(c) i > iii > ii
(d) iii > i > ii

25. Identify correct acidic strength order in the following compounds



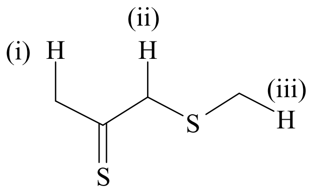
(a) i > ii > iii
(b) ii > iii > i
(c) i > iii > ii
(d) iii > i > ii

26. Identify correct acidic strength order in the following compounds



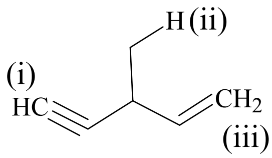
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

27. Identify correct acidic strength order in the following compounds



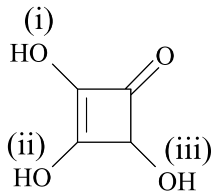
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) ii > i > iii

28. Identify correct acidic strength order in the following compounds



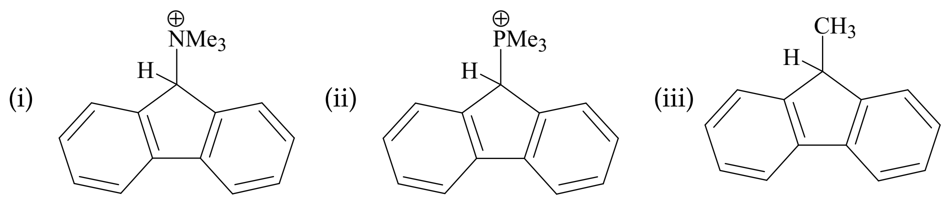
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

29. Identify correct acidic strength order in the following compounds



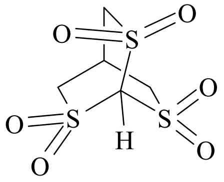
(a) ii > i > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

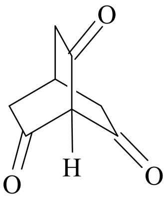
30. The acidity of the protons H in each of the following is

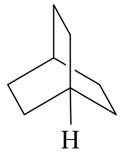


(a) i > ii > iii (b) ii > iii > i (c) ii > i > iii (d) iii > i > ii

31. The acidity of the protons H in each of the following is

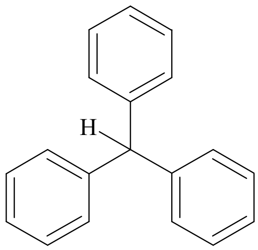
(i) 

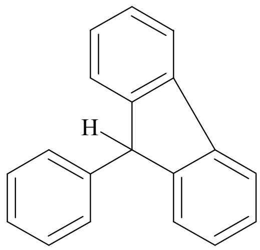
(ii) 

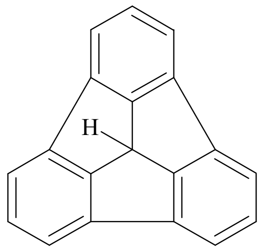
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

32. Identify correct acidic strength order in the following compounds

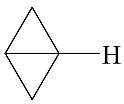
(i) 

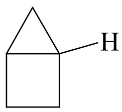
(ii) 

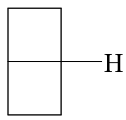
(iii) 

(a) iii > ii > i (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

33. Identify correct acidic strength order in the following compounds

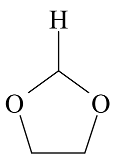
(i) 

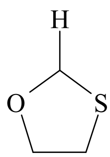
(ii) 

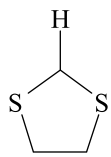
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

34. Identify correct acidic strength order in the following compounds

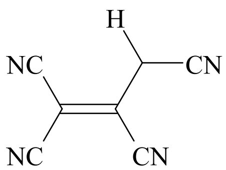
(i) 

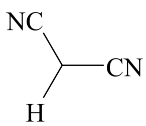
(ii) 

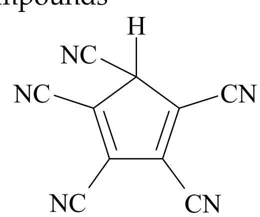
(iii) 

(a) i > ii > iii (b) iii > ii > i (c) i > iii > ii (d) iii > i > ii

35. Identify correct acidic strength order in the following compounds

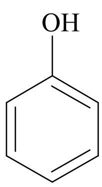
(i) 

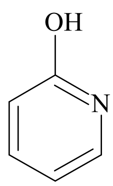
(ii) 

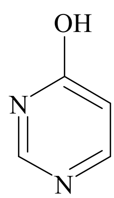
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

36. Identify correct acidic strength order in the following compounds

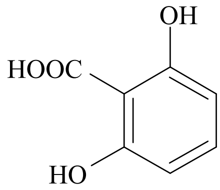
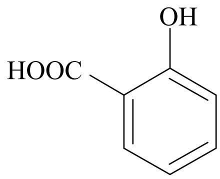
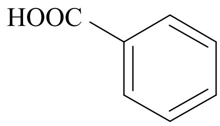
(i) 

(ii) 

(iii) 

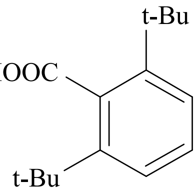
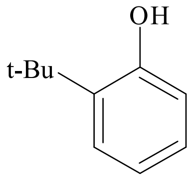
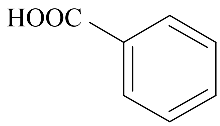
(a) iii > ii > i (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

37. Identify correct acidic strength order in the following compounds

(i)  (ii)  (iii) 

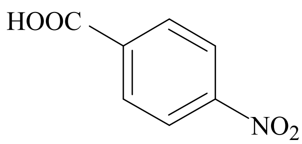
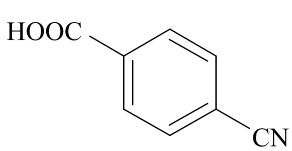
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

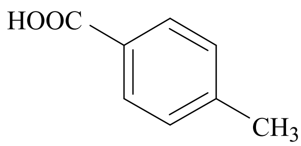
38. Identify correct acidic strength order in the following compounds

(i)  (ii)  (iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

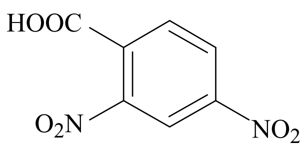
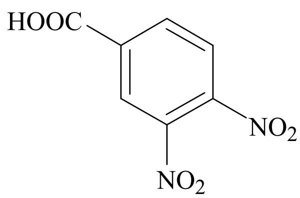
39. Identify correct acidic strength order in the following compounds

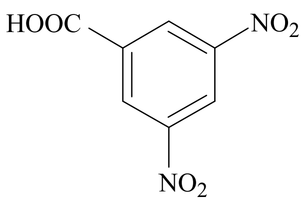
(i)  (ii) 

(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

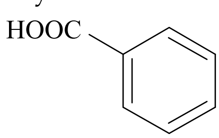
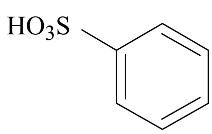
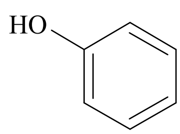
40. Identify correct acidic strength order in the following compounds

(i)  (ii) 

(iii) 

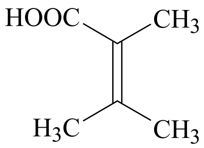
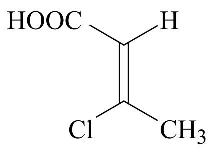
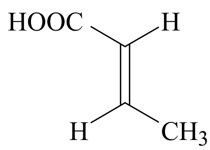
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

41. Identify correct acidic strength order in the following compounds

(i)  (ii)  (iii) 

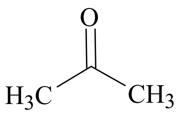
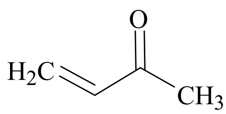
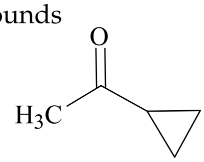
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) ii > i > iii

42. Identify correct acidic strength order in the following compounds

(i)  (ii)  (iii) 

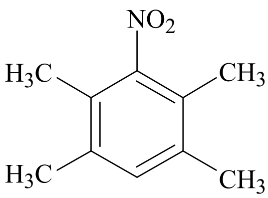
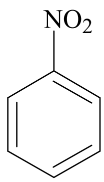
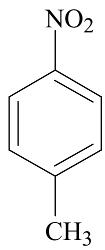
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

43. Identify correct dipole moment order in the following compounds

(i)  (ii)  (iii) 

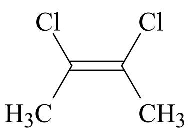
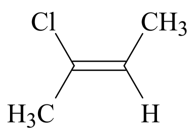
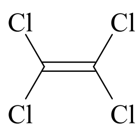
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > ii > i

44. Identify correct dipole moment order in the following compounds

(i)  (ii)  (iii) 

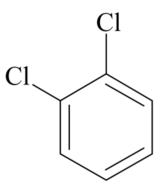
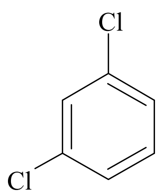
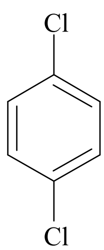
(a) i > ii > iii (b) iii > ii > i (c) i > iii > ii (d) iii > i > ii

45. Identify correct dipole moment order in the following compounds

(i)  (ii)  (iii) 

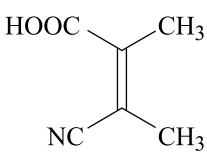
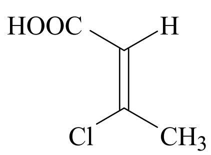
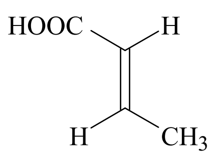
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

46. Identify correct dipole moment order in the following compounds

(i)  (ii)  (iii) 

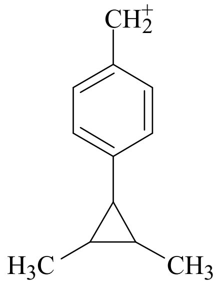
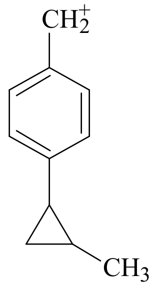
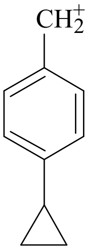
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

47. Identify correct acidic strength order in the following compounds

(i)  (ii)  (iii) 

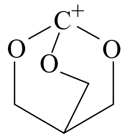
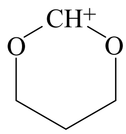
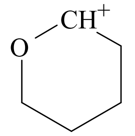
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

48. Identify correct stability order in the following compounds

(i)  (ii)  (iii) 

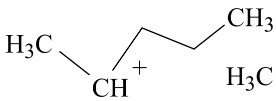
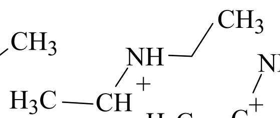
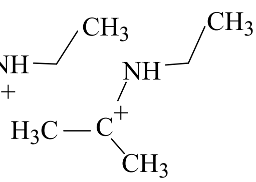
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

49. Identify correct stability order in the following compounds

(i)  (ii)  (iii) 

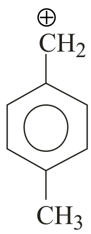
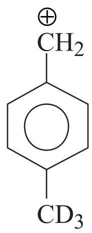
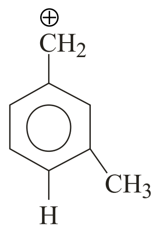
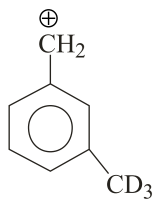
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

50. Identify correct stability order in the following compounds

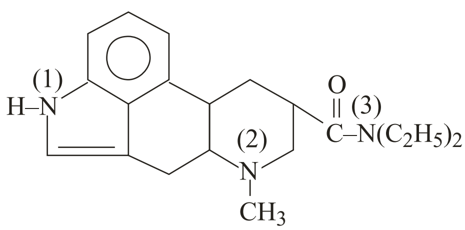
(a) i > ii > iii (b) ii > iii > i (c) iii > ii > i (d) iii > i > ii

51. Correct order of stability of the following carbocation is

(i)  (ii)  (iii)  (iv) 

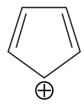
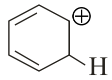
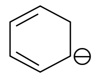
(a) i > ii > iii > iv
(b) i > ii > iv > iii
(c) ii > i > iv > iii
(d) i > iv > ii > iii

52. Which nitrogen in LSD is most basic?

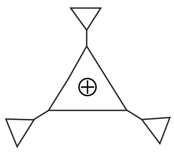
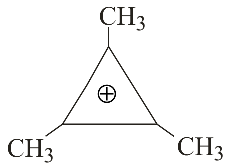
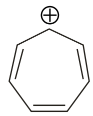
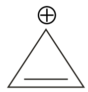


(a) 1
(b) 2
(c) 3
(d) All are equally basic

53. Which one of the following ion is aromatic?

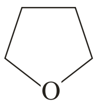
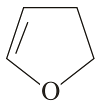
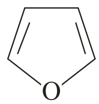
(a)  (b)  (c)  (d) 

54. Arrange the following carbocations in decreasing order of their stability?

(i)  (ii)  (iii)  (iv) 

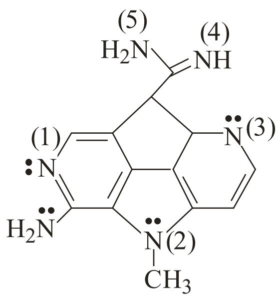
(a) i, ii, iii, iv (b) i, ii, iv, iii (c) i, iii, ii, iv (d) iv, iii, ii, i

55. Arrange the following in decreasing order of their solubility in water or extent of hydrogen bonding with H_2O

(i)  (ii)  (iii) 

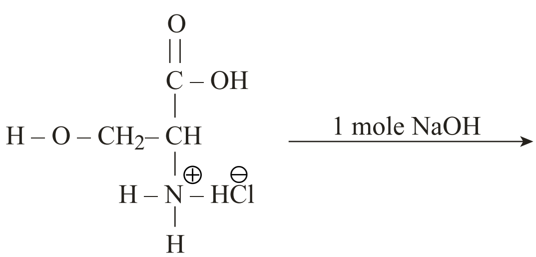
(a) i, ii, iii (b) iii, ii, i (c) ii, iii, i (d) iii, i, ii

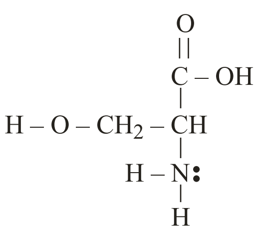
56. The decreasing order of basic strength is

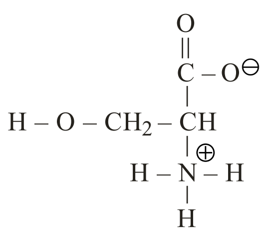


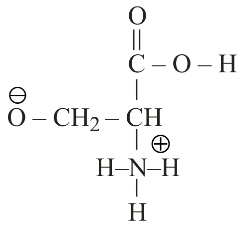
(a) i > v > iii > iv > ii
(b) iv > i > v > iii > ii
(c) v > iv > i > ii > iii
(d) iv > v > iii > i > ii

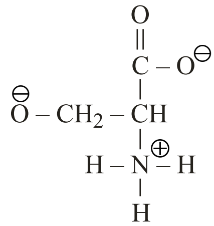
57. What is the major product obtained from the following reaction?



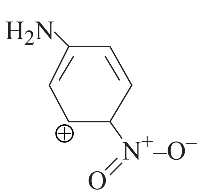
(a) 

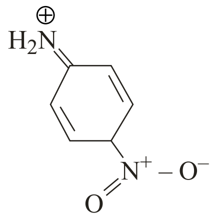
(b) 

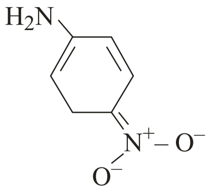
(c) 

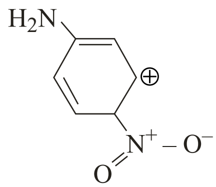
(d) 

58. All the following are the resonance structure of one another except

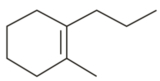
(a) 

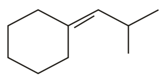
(b) 

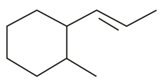
(c) 

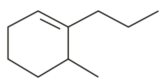
(d) 

59. Which of the following shows minimum heat of combustion?

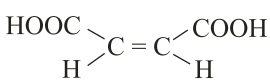
(a) 

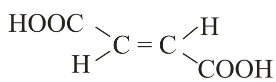
(b) 

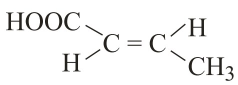
(c) 

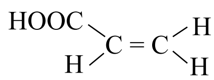
(d) 

60. Arrange the following in the decreasing order of their acidic strength

(i) 

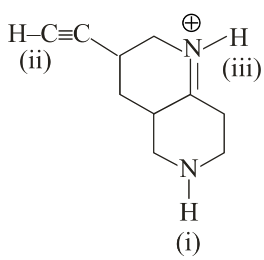
(ii) 

(iii) 

(iv) 

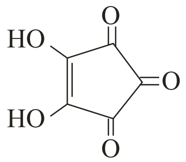
(a) i > ii > iii > iv
(b) iv > iii > ii > i
(c) ii > i > iv > iii
(d) i > ii > iv > iii

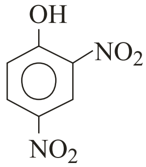
61. Arrange the following hydrogens in the order of their acidic behaviour

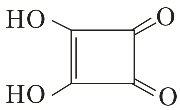


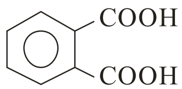
(a) i > iii > ii
(b) ii > iii > i
(c) i > ii > iii
(d) iii > ii > i

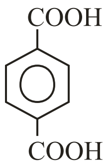
62. Which of the following acid gives evolution of CO_2 with $NaHCO_3$?

(i) 

(ii) 

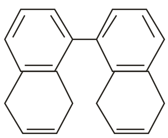
(iii) 

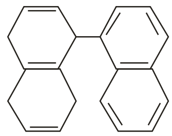
(iv) 

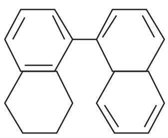
(v) 

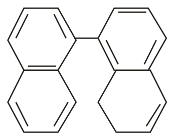
(a) i, iii, iv, v (b) iii, iv, v (c) i, ii, iii iv, v (d) i, iii, iv

63. Maximum resonance energy is known for

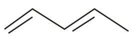
(a) 

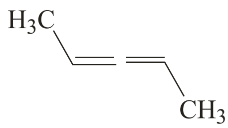
(b) 

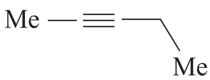
(c) 

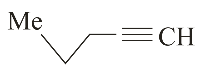
(d) 

64. Arrange the following in the order of their heat of hydrogenation, when all of them are converted to n-pentane

(i) 

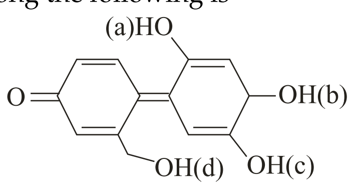
(ii) 

(iii) 

(iv) 

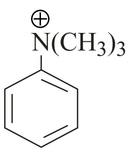
(a) ii > iii > i > iv
(b) i > iv > ii > iii
(c) iv > ii > i > iii
(d) ii > iv > iii > i

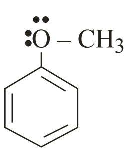
65. Most acidic hydrogen among the following is

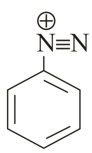


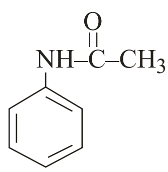
(a) a (b) b (c) c (d) d

66. In which of the following molecule the mesomeric effect does not operate?

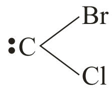
(a) 

(b) 

(c) 

(d) 

67. Which is not carbene out of the following?

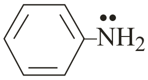
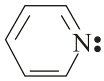
(a) $:CH_2$ (b) $:CCl_2$ (c)  (d) $:CCl_3$

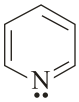
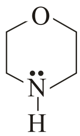
68. Out of the following reagents, pure electrophiles are

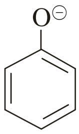
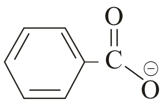
(P) R_3N (Q) $:CCl_2$ (R) $CH_3^{\oplus}$ (S) H_2O (T) $H_3O^{\oplus}$ (U) $Na^{\oplus}$

(a) Q, R, T, U (b) Q, R (c) Q, R, S, T (d) Q, R, S, T, U

69. Select the correct statement

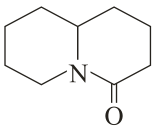
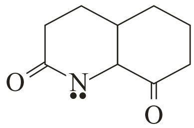
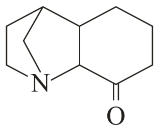
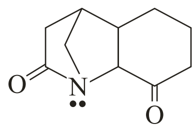
(a)  is more basic than 

(b)  is more basic than 

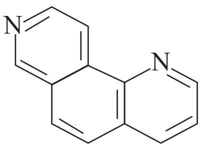
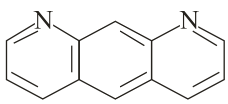
(c)  is more basic than 

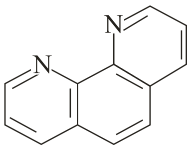
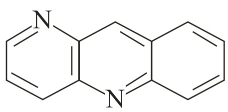
(d) All of them

70. Which of the following is most basic?

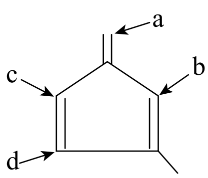
(a)  (b)  (c)  (d) 

71. Which of the following is most basic?

(a)  (b) 

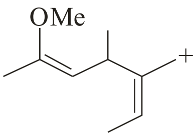
(c)  (d) 

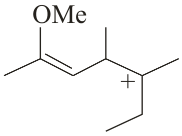
72. Which is the least likely protonation site in the conjugated alkene shown below?

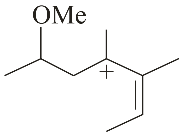


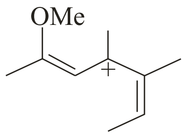
(a) a (b) b (c) c (d) d

73. Which of the following is the most stabilised carbocation?

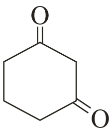
(a) 

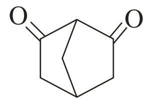
(b) 

(c) 

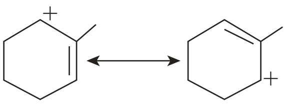
(d) 

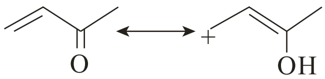
74. Which one of the following compounds would you expect to be the strongest carbon acid?

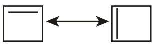
(a) 

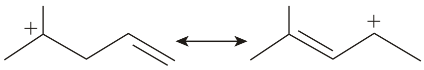
(b) $CH_2(COOEt)_2$ (c) CH_3COCH_2COOEt (d) 

75. Which of the following is a pair of resonance structure?

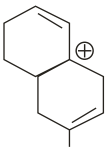
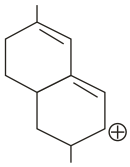
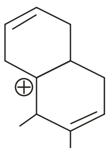
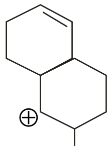
(a) 

(b) 

(c) 

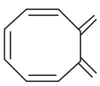
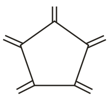
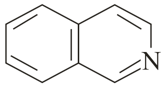
(d) 

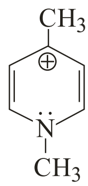
76. Rank the following carbocations in increasing order of stability

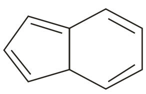
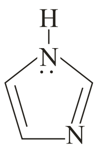
(i)  (ii)  (iii)  (iv) 

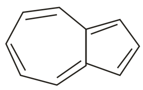
(a) iv < iii < i < ii (b) iv < i < iii < ii (c) iii < ii < i < iv (d) i < iii < ii < iv

77. In which of the following option correctly follow aromaticity?

(i)  (ii)  (iii) 

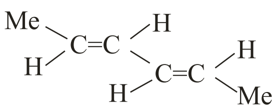
(iv) 

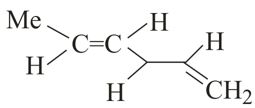
(v)  (vi) 

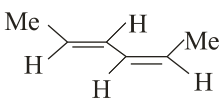
(vii) 

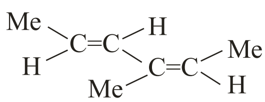
(a) i, iii, iv, vii (b) iii, iv vi, vii (c) i, iii, iv, vii (d) i, iv, vi, vii

78. Which of the following is the correct order for decreasing order of heat of hydrogenation (magnitude)?

(i) 

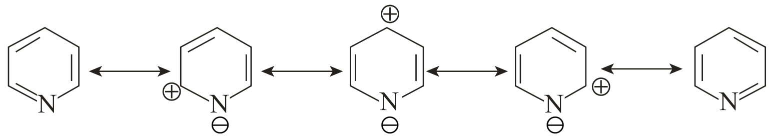
(ii) 

(iii) 

(iv) 

(a) i > ii > iii > iv (b) ii > i > iii > iv (c) iv > iii > i > ii (d) ii > iii > i > iv

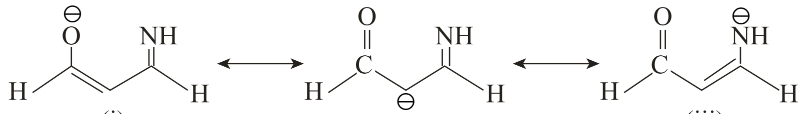
79. Among the following canonical structures of pyridine, the correct order of stability is



(i) (ii) (iii) (iv) (v)

(a) (i = v) > (ii = iv) > iii
(b) (ii = iv) > (i = v) > iii
(c) (i = v) > iii > (ii = iv)
(d) iii > (ii = iv) > (i = v)

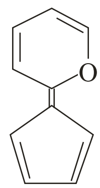
80. The correct order of stability among the following canonical structures is

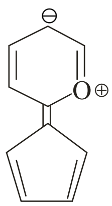
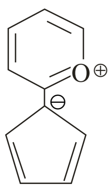
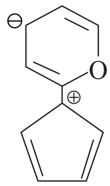
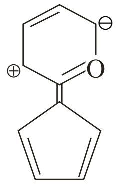


(i) (ii) (iii)

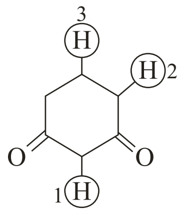
(a) i > ii > iii
(b) i > iii > ii
(c) ii > i > iii
(d) iii > i > ii

81. The most stable canonical structure of the given molecule is



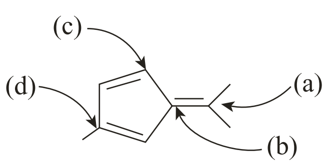
(a) 
(b) 
(c) 
(d) 

82. Which of the following order is correct for the acidity of indicated H-atoms?



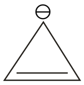
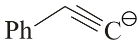
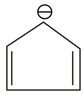
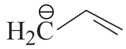
(a) (H)1 > (H)2 > (H)3
(b) (H)3 > (H)2 > (H)1
(c) (H)2 > (H)1 > (H)3
(d) (H)1 > (H)3 > (H)2

83. Which is the least likely protonation site in the conjugated alkene shown below?

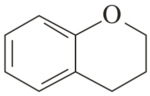
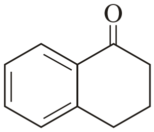
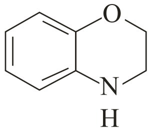
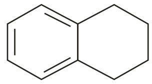


(a) a
(b) b
(c) c
(d) d

84. Which of the following carbanion is most stable?

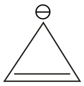
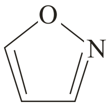
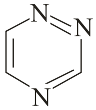
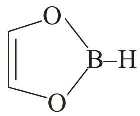
(a)  (b)  (c)  (d) 

85. Identify correct order of electron cloud in benzene ring for the following compounds

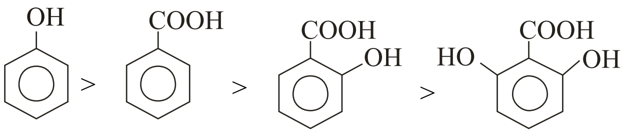
(i)  (ii)  (iii)  (iv) 

(a) iv > i > iii > ii (b) iii > i > iv > ii (c) i > iii > iv > ii (d) iii > ii > i > iv

86. Which of the following is antiaromatic?

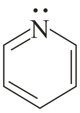
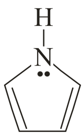
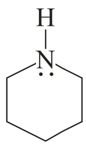
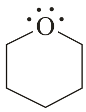
(a)  (b)  (c)  (d) 

87. The correct order of pK_a is

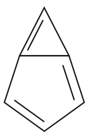
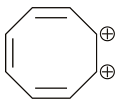
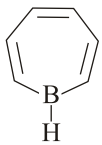
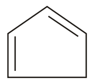
(a) 

(b) $HClO_4 > H_2SO_4 > HNO_3 > HNO_2$
(c) HOCl > HOF > HOBr > HOI
(d) $H_2O_2 > ROH > H_2O$ (R = Et group)

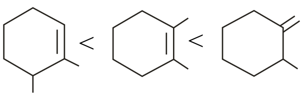
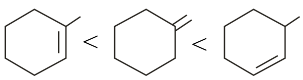
88. Which of the following is the strongest base?

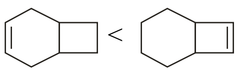
(a)  (b)  (c)  (d) 

89. Among the following compounds which nonaromatic?

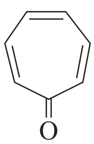
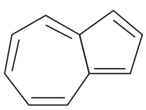
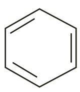
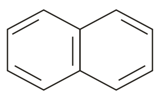
(a)  (b)  (c)  (d) 

90. Identify correct order of heat of hydrogenation

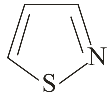
(a)  (b) 

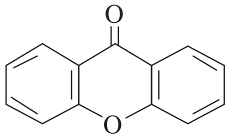
(c)  (d) 

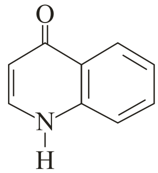
91. Dipole moment of which compound(s) is/are not zero?

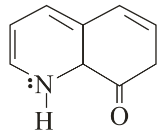
(a)  (b)  (c)  (d) 

92. Which of the following is/are aromatic?

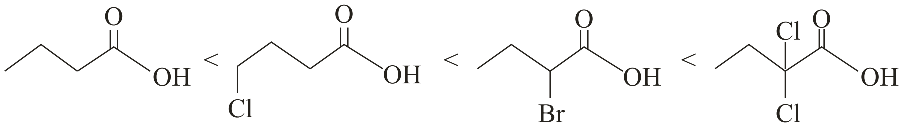
(a) 

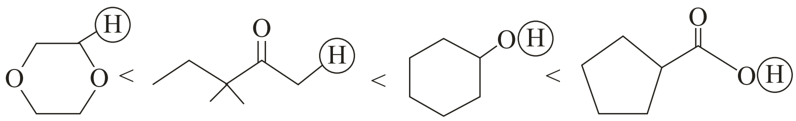
(b) 

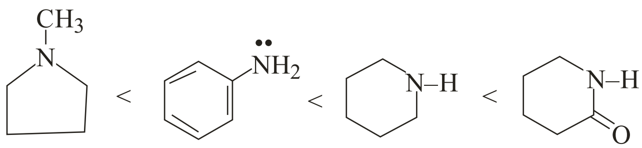
(c) 

(d) 

93. Which of following represent the correct order of acidity?

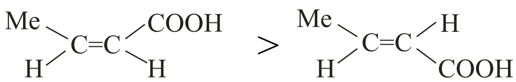
(a) 

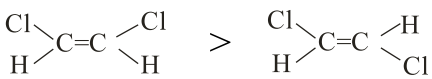
(b) 

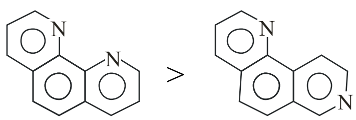
(c) 

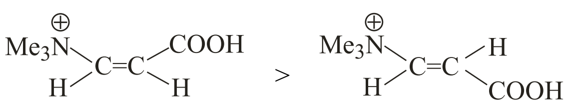
(d) Ph–O–CH_3 < Ph–CH_2–OH < Ph–OH < Ph – C(=O) – OH

94. Which of the following is correct?

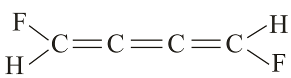
(a)  (acidic strength)

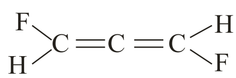
(b)  (dipole moment)

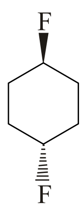
(c)  (basicity)

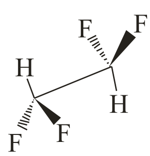
(d)  (acidic strength)

95. Which of the following molecules have dipole moment?

(a) 

(b) 

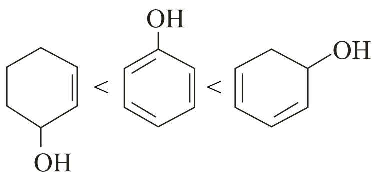
(c) 

(d) 

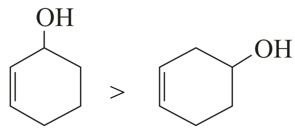
96. $CH_3-CH_2-NH_2 \xrightarrow[HCl]{NaNO_2} [P]$; Products of the reaction are:

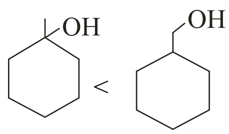
(a) $CH_3–CH_2–OH$ (b) Et–Cl (c) $Et-\overset{O}{\overset{||}{C}}-H$ (d) Et–ONO

97. Identify correct order of rate of dehydration

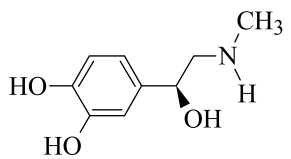
(a) 

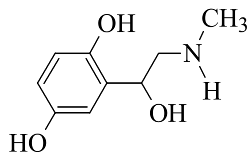
(b) $Ph-\underset{Me}{\overset{OH}{C}}-CH_3 > Ph-\underset{CH_3}{CH}-CH_2-OH$

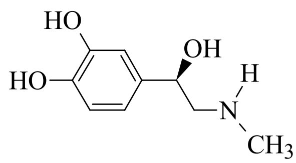
(c) 

(d) 

98. Choose the constitutional isomer(s) of epinephrine (among following structures)

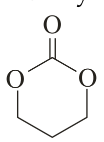
(i) 

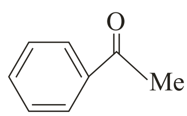
(ii) 

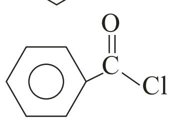
(iii) 

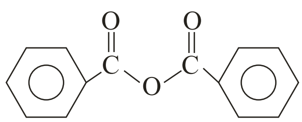
(a) i (b) ii (c) iii (d) i & ii

99. 2-phenyl-2-propanol can be prepared by treating which of these compounds with MeMgBr followed by hydrolysis?

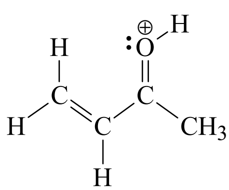
(a) 

(b) 

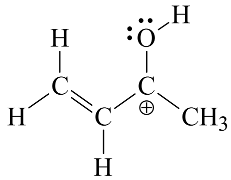
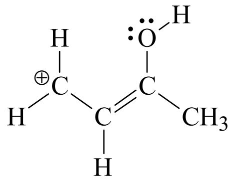
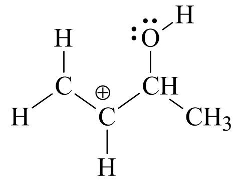
(c) 

(d) 

100. Choose those that are resonance structures of protonated methyl vinyl ketone.

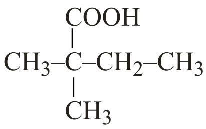
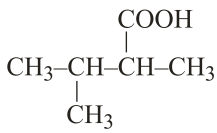


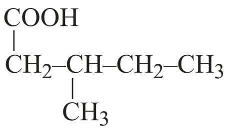
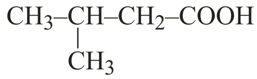
protonated methyl vinyl ketone

(i)  (ii)  (iii) 

(a) i (b) ii (c) iii (d) i and ii

101. Which of the following acid will give isopentane on decarboxylation with soda lime?

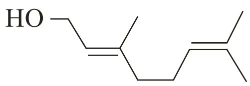
(a)  (b) 

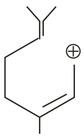
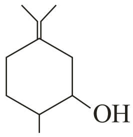
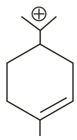
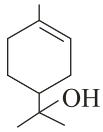
(c)  (d) 

102. Which of the following alkane can not be synthesised by Wurtz reaction in good yield?

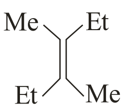
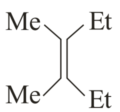
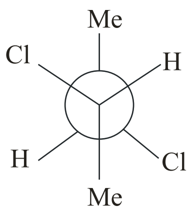
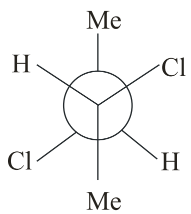
(a) $(CH_3)_2$–CH–CH_2–CH–$(CH_3)_2$ (b) $(CH_3)_2$CH–CH_2–CH_2–CH–$(CH_3)_2$

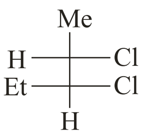
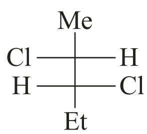
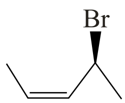
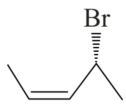
(c) CH_3–CH_2–C$(CH_3)_2$–CH_2–CH_3 (d) CH_3–CH_2–CH_2–CH_3

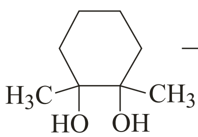
103.  $\xrightarrow[H_2O]{H^+}$ product and intermediate form is/are:

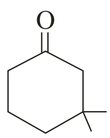
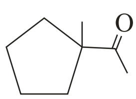
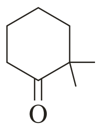
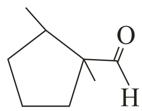
(a)  (b)  (c)  (d) 

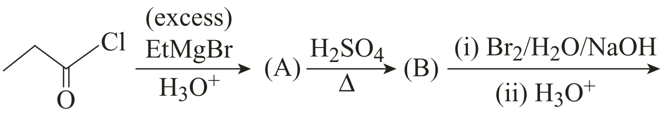
104. Among the following pair(s) of compounds identify enantiomeric pairs

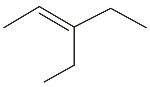
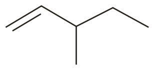
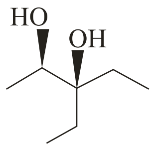
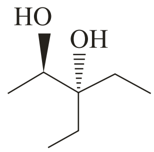
(a)  and  (b)  and 

(c)  and  (d)  and 

105.  $\xrightarrow{H^+}$ possible products obtained is/are

(a)  (b)  (c)  (d) 

106.  (C) ; Products B and C are

(a)  (b)  (c)  (d) 

107. Which statement is/are correct in the following?

(a) Allyl bromide gives S_{N^1} reaction but vinyl chloride does not.

(b) Primary alkyl halides can give S_{N^1} or S_{N^2} reaction. This depends on the structure of the substrate and nature of solvent.

(c) CH_3–CH=CH–CH_2Cl reacts with KCN to give mixture of two isomeric products.

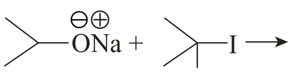
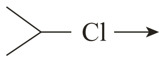
(d) CH_3–CH_2–O–CH_2Br is less reactive than tert. butyl bromide for S_{N^1} reaction.

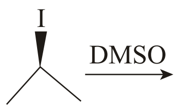
108. Test for identification of But-2-ene and benzene is

(a) Tollen's Reagent test (b) 1% Alkaline $KMnO_4$

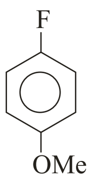
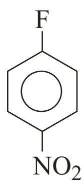
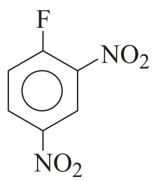
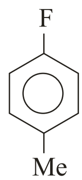
(c) Iodoform test (d) $Br_2 + H_2O$ test

109. Identify the reaction that follows S_{N^2} path

(a)  (b) NaI/Acetone + 

(c) NaSH +  (d) NaN_3 + 

110. Among the following compounds, which liberates F^- on reaction with MeO^-?

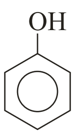
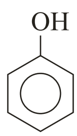
(a)  (b)  (c)  (d) 

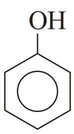
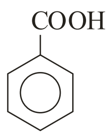
111. Identify reagents used for the following conversions

$$Me-\overset{\overset{O}{\|}}{C}-NH_2 \longrightarrow Me-C\equiv N$$

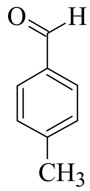
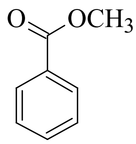
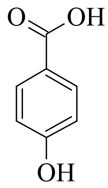
(a) P_2O_5/Δ (b) NaCl/Δ (c) $POCl_3/\Delta$ (d) Al_2O_3/Δ

112. Among the following reactions, which form salicylic acid (after acidification)?

(a)  + $CHCl_3$ + NaOH ⟶ (b)  + CCl_4 + NaOH ⟶

(c)  + CO_2 + NaOH ⟶ (d)  + NaOH ⟶

113. Choose the order for increasing boiling point of the following compounds.

(i)  (ii)  (iii) 

(a) (i) → (ii) → (iii) (increasing boiling point)

(b) (ii) → (i) → (iii) (increasing boiling point)

(c) (i) → (iii) → (ii) (increasing boiling point)

(d) (ii) → (iii) → (i) (increasing boiling point)

114.  ; identify reagent which reduces both groups

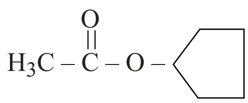
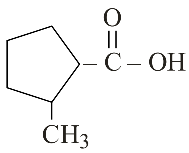
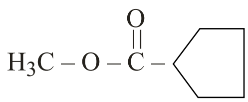
(a) $NaBH_4$

(b) LAH

(c) Zn–Hg/HCl

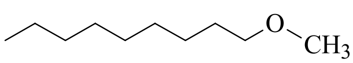
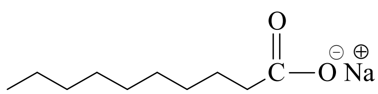
(d) $NH_2–NH_2/OH^-/\Delta$

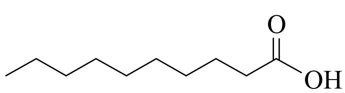
115. For the given compounds, correct statement is/are

(i)  (ii)  (iii) 

(a) i and ii are positional isomers
(b) ii and iii are functional group isomers
(c) i and iii are metamers
(d) i and iii are positional isomers

116. Choose the order that has the following compounds correctly arranged with respect to increasing solubility in water.

(i)  (ii) 

(iii) 

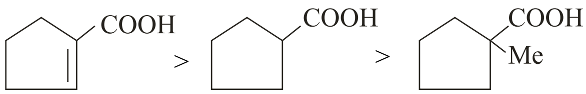
(a) (ii) → (i) → (iii) (increasing solubility)

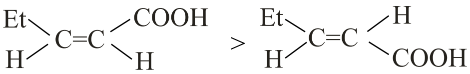
(b) (i) → (ii) → (iii) (increasing solubility)

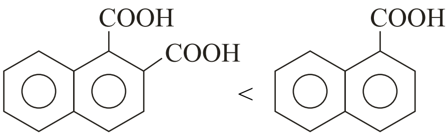
(c) (i) → (iii) → (ii) (increasing solubility)

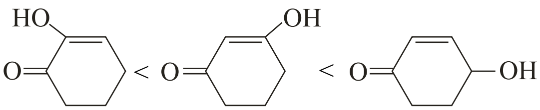
(d) (ii) → (iii) → (i) (increasing solubility)

117. Which of following order is/are correct for acidic strength?

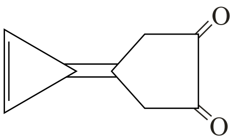
(a) 

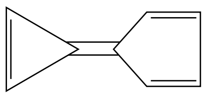
(b) 

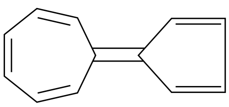
(c) 

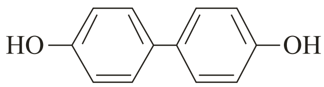
(d) 

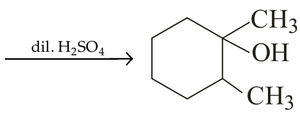
118. Which has non-zero dipole moment?

(a) 

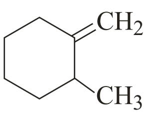
(b) 

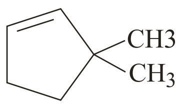
(c) 

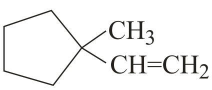
(d) 

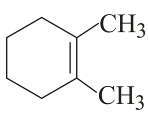
119. Compound (A) 

Compound (A) can be

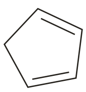
(a) 

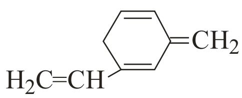
(b) 

(c) 

(d) 

120. Which of the following gives glyoxal as one of the product on ozonolysis?

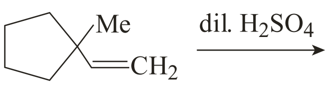
(a) 

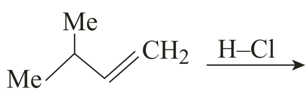
(b) 

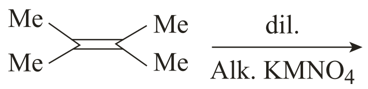
(c) $H_2C=CH-CH=CH_2$

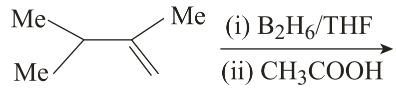
(d) Benzene

121. In which of the following reactions the rearrangment of carbocation is involved?

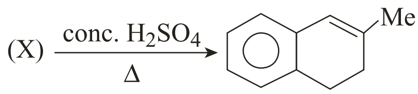
(a) 

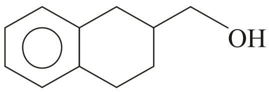
(b) 

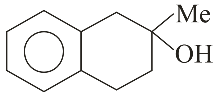
(c) 

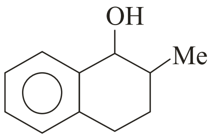
(d) 

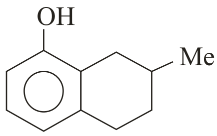
122. In the given reaction, the possible structure of compound (X) is



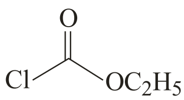
(a) 

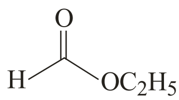
(b) 

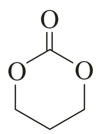
(c) 

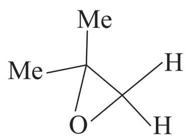
(d) 

123. Which of the following compounds will give or tertiary alcohol as a resultant product when they are treated with either 1 mole of MeMgBr or with excess MeMgBr followed by H_2O?

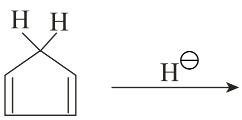
(a) 

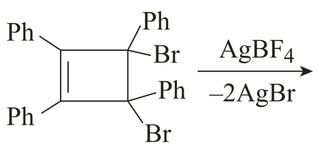
(b) 

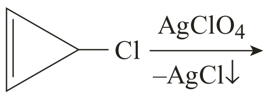
(c) 

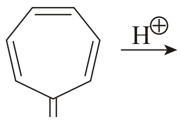
(d) 

124. Which of the following reactions give an aromatic product?

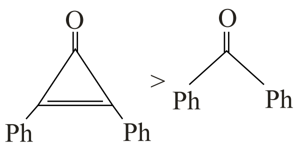
(a) 

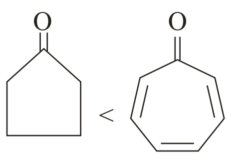
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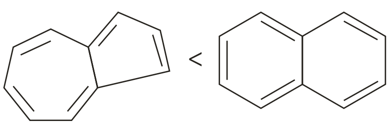
(c) 

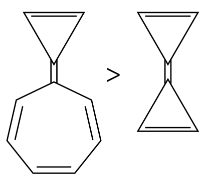
(d) 

125. Identify the correct order of dipole moment

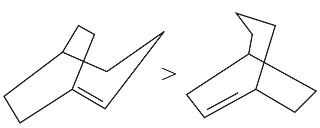
(a) 

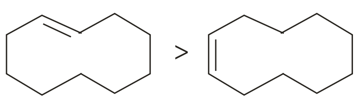
(b) 

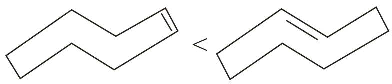
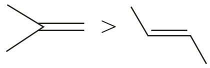
(c) 

(d) 

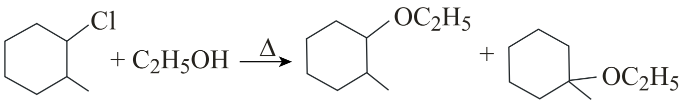
126. Identify the correct order of heat of hydrogenation

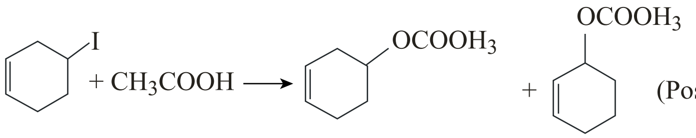
(a) 

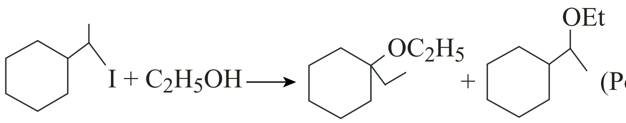
(b) 

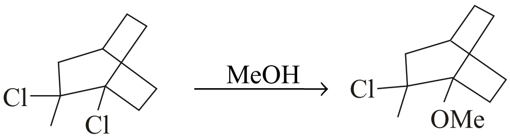
(c)  (d) 

127. Which of the following reactions give the correct product?

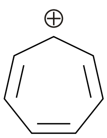
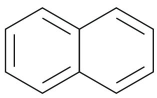
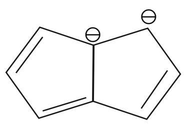
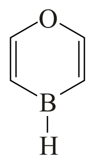
(a)  (Possible product)

(b)  (Possible product)

(c)  (Possible product)

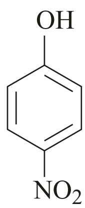
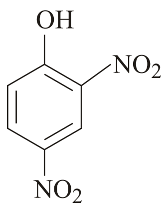
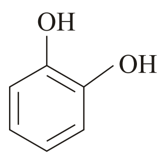
(d)  (Major product)

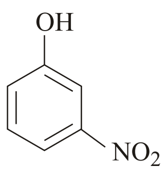
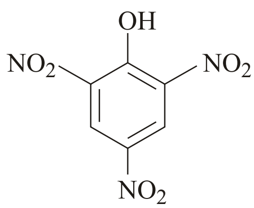
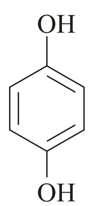
128. From the compound shown below, choose which is aromatic

(a)  (b)  (c)  (d) 

Comprehension Type

Passage 1

(i)  (ii)  (iii) 

(iv)  (v)  (vi) 

129. The correct order of Ka value is:
(a) i > iii > iv (b) iv > iii > vi (c) v > vi > iii (d) ii > i > iv

130. Which of the following gives effervescence with $NaHCO_3$?
(a) ii (b) vi (c) iii (d) iv

131. Which of the following pairs of phenol derivative are stronger acid than phenol?

(a) i, ii, iv (b) ii, iv, vi (c) i, ii, vi (d) v, iii, vi

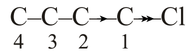
Passage 2

In a covalent single bond between unlike atoms, the electron pair forming the σ bond is never shared absolutely equally between the two atoms; it tends to be attracted a little more towards the more electronegative atom of the two.

This is generally represented as



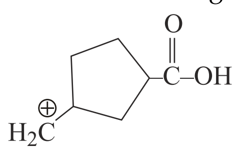
If the carbon atom bonded to chlorine is itself attached to further carbon atoms, the effect can be transmitted further as

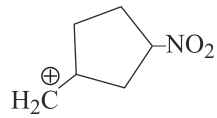


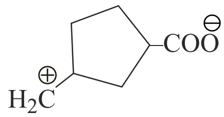
The effect of Cl on C_2 is less than the effect of Cl on C_1; however, the transmission quickly dies away in a saturated chain, usually being too small to be noticeable beyond C_2. These influences on the electron distribution in σ bonds are known as **inductive effects.**

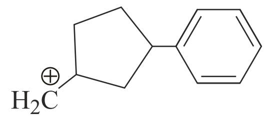
Electron releasing groups w.r.t. the hydrogen atom are known to have +I effect and electron withdrawing groups are known to have –I effect. Electron donating group increases the stability of carbocation and withdrawing group increases the stability of carbanion.

132. Which of the following carbocation is expected to be most unstable?

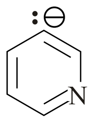
(a) 

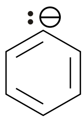
(b) 

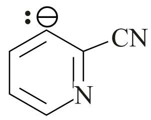
(c) 

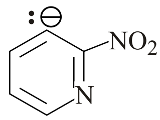
(d) 

133. Correct order of the stability of the given carbanion is

(i) 

(ii) 

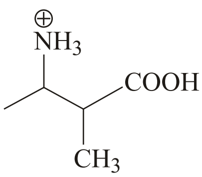
(iii) 

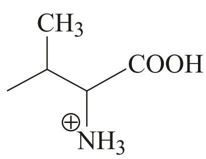
(iv) 

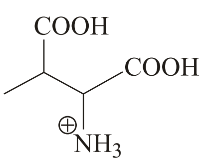
(a) i > ii > iii > iv (b) ii > i > iii > iv

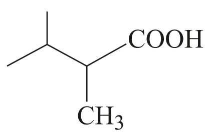
(c) iv > iii > ii > i (d) iv > iii > i > ii

134. Most acidic compound in aqueous medium is

(a) 

(b) 

(c) 

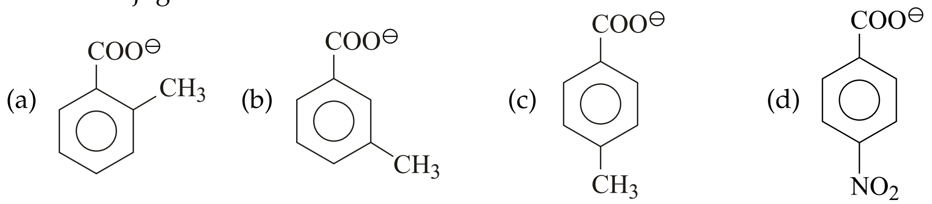
(d) 

Passage 3

Benzoic acid is more acidic than acetic acid. Acidity of formic acid is more than the benzoic acid. Among monosubstituted benzoic acid derivatives, the ortho derivative is most acidic due to ortho effect. Acidity of any acid can be explained by the stability of conjugate base of the acid.

135. Which of the following is most acidic in character?
(a) o-nitrobenzoic acid (b) p-nitrobenzoic acid
(c) m-nitrobenzoic acid (d) Benzoic acid

136. Which conjugate base is most stable?

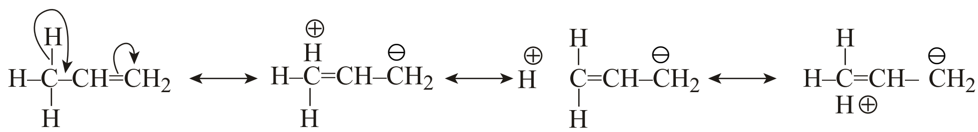


137. Arrange acidity of the given compounds increasing order
(i) p-nitrophenol (ii) p-fluorophenol (iii) p-chlorophenol
(a) (i), (ii), (iii) (b) (ii), (i), (iii) (c) (ii), (iii), (i) (d) (iii), (ii), (i)

Passage 4

When (C–H) sigma electrons are in conjugation with pi bond, this conjugation is known as σ (C–H) π conjugation, excessive conjugation or hyperconjugation.

(i) Compound should have at least one sp^2-hybrid carbon of either alkene, alkyl carbocation or alkyl free radical.
(ii) α-carbon with respect to sp^2 hybrid carbon should have at least one hydrogen.
(iii) Resonating structures due to hyperconjugation may be written involving "no bond" between the alpha carbon and hydrogen atoms.



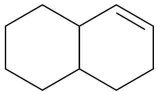
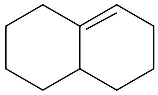
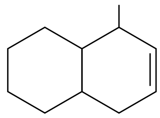
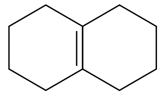
In the above resonating structures there is no covalent bond between carbon and hydrogen, and from this point of view, hyperconjugation may be regarded as "no bond resonance". Actually the hydrogen atom is not free from the carbon. These resonating structures only suggest that: (a) there is some ionic character between C–H bond and (b) carbon–carbon double bond acquires some single bond character.

We can explain the stability of alkene, carbocation and carbon free radical on the basis of hyperconjugation.

$$\text{Stability of alkene} \propto \text{number of } \alpha\text{–H} \propto \frac{1}{\text{Heat of hydrogenation}}$$

138. Which of the following statements are correct for C_6H_5–CCl_3?
(a) CCl_3 group is electron withdrawing due to the –I effect and reverse hyperconjugation.
(b) CCl_3 group is meta directing due to the –M effect.
(c) CCl_3 group is o, p-directing because it is +R group.
(d) CCl_3 group can exert +M effect.

139. Which of the following has the lowest heat of hydrogenation?

(a)  (b)  (c)  (d) 

140. Carbon–carbon double bond length will be maximum in which of the following compounds?

(a) $CH_3–CH=CH_2$ (b) $CH_3–CH=CH–CH_3$ (c) $CH_3–\underset{CH_3}{C}=\overset{CH_3}{C}–CH_3$ (d) $CH_2=CH_2$

Passage 5

For a compound to be classified as aromatic, it must fulfill both of the following criteria.

(i) It must have an uninterrupted cyclic cloud of π electrons above and below the plane of the molecule (often called a π cloud).

For the π cloud to be cyclic, the molecule must be cyclic.

For the π cloud to be uninterrupted, every atom in the ring must have a p orbital.

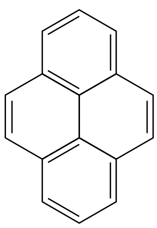
For the π cloud to form, each p orbital must be able to overlap with the p orbitals on either side of it. Therefore, the molecule must be planar.

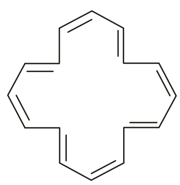
(ii) The π cloud must contain an odd number of pairs of π electrons.

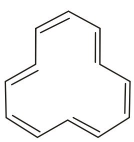
Benzene is an aromatic compound because it is cyclic and planar, every carbon in the ring has a p orbital and the π cloud contains three pairs of π electrons.

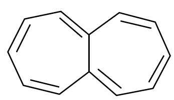
The German chemist Erich Huckel was the first to recognise that an aromatic compound must have an odd number of pairs of π electrons. He described this requirement by what has come to be known as Huckel's rule, or the $4n + 2$ rule. The rule states that for a planar, cyclic compound to be aromatic, its uninterrupted π cloud must contain $(4n + 2)$ π electrons, where n is any whole number. According to Huckel's rule, then an aromatic compound must have 2 ($n = 0$), 6($n = 1$), 10 ($n = 2$), 14 ($n = 3$), 18 ($n = 4$), etc. π electrons. Because there are two electrons in a pair, Huckel's rule requires that an aromatic compound must have 1, 3, 5, 7, 9, etc. pairs of π electron. Thus, Huckel's rule is just a mathematical way of saying that an aromatic compound must have an odd number of pairs of π electrons. For an anti-aromatic system a planar, cyclic compound must contain $(4n)$ π electrons.

141. Which one of the following compounds is non-aromatic?

(i) 

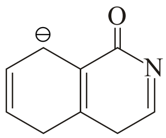
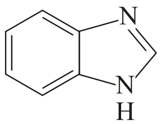
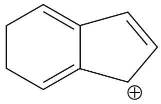
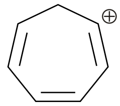
(ii) 

(iii) 

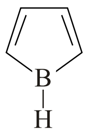
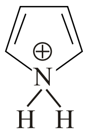
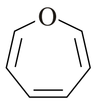
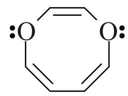
(iv) 

(a) only i (b) i and iv (c) ii, iii, iv (d) i and ii

142. Which of the following will show aromatic behaviour?

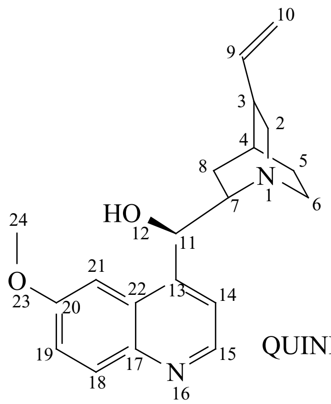
(a)  (b)  (c)  (d) 

143. Which of following is a non-aromatic system?

(a)  (b)  (c)  (d) 

Passage 6

For each of the questions 149–154 about QUININE (shown right), select the answer from those provided.



QUININE

144. What is the oxidation state of C11?
(a) +1 (b) 0 (c) –1 (d) –2

145. Of the following list, which atom(s) is (are) sp3 hydridised?
(a) O12 (b) N16 (c) C21 (d) N1

146. Which of the following carbon atoms are tertiary?
(a) C24 (b) C19 (c) C20 (d) C22

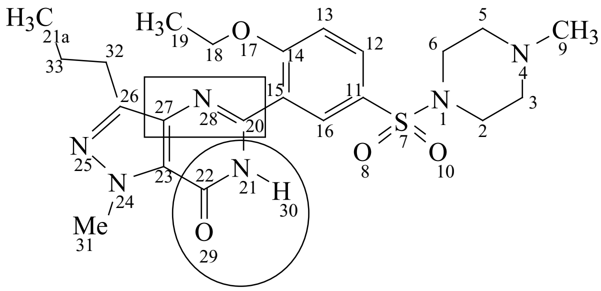
147. Which carbon atom(s) is (are) ortho to a methoxy group?
(a) C5 (b) C6 (c) C7 (d) C21

148. Which of the following functional groups are found in QUININE?
(a) Alcohol (b) Amide (c) Ester (d) Ether

149. How many units of unsaturation are there in QUININE? (units of unsaturation are the same as the index of hydrogen deficiency or IHD)
(a) 7 (b) 8 (c) 9 (d) 10

Passage 7

In the year of its launch, VIAGRA (below) was used by over three million satisfied customers. Each of the questions below refers to the structure of VIAGRA. Now select the answer(s) from the options provided.



150. What are the oxidation states of C3 and N25?
(a) −1, −2 (b) +1, −2 (c) −1, +3
(d) −1, −3 (e) +1, −3

151. What is the functional group in the circle?
(a) amide (b) amine (c) aniline (d) nitrile

152. What is the functional group in the rectangular box?
(a) epoxide (b) amine (c) ester (d) ether

153. How many units of unsaturation are there in VIAGRA?
(a) 7 (b) 8 (c) 11
(d) 12 (e) 13

154. In VIAGRA, what are the hybridisations of O10, N4 and N28, respectively?
(a) sp^3, sp^3, sp^3 (b) sp^2, sp^3, sp^3 (c) sp^3, sp^2, sp^3 (d) sp^2, sp^3, sp^2

155. In VIAGRA, what are the hybridisations of C2, C3 and N24, respectively?
(a) sp^3, sp^3, sp^3 (b) sp^2, sp, sp^3 (c) sp^3, sp^2, sp^3 (d) sp^3, sp^3, sp^2

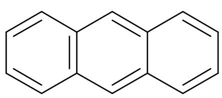
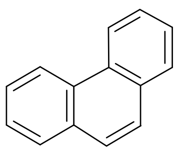
156. How many carbon chiral centres are there in VIAGRA?
(a) 0 (b) 1 (c) 2 (d) 3

Matrix Type

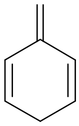
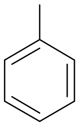
157.

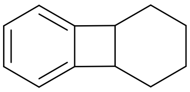
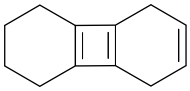
Column I (Groups)	Column II (Effect)
(a) $-\overset{\oplus}{N}Me_3$	(p) +I
(b) $-\overset{\oplus}{P}Me_3$	(q) –I
(c) –OMe	(r) +R
(d) $-CH_3$	(s) –R
	(t) +H

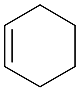
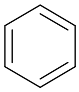
158. **Column I** **Column II**

(a)  and 

(p) (i) compound has more heat of hydrogenation than (ii)

(b)  and 

(c)  and 

(d)  and 

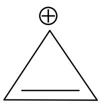
(q) (i) compound has more resonance energy than (ii) compound

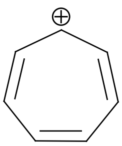
(r) (i) compound is more stable than (ii)

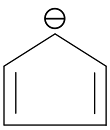
(s) (ii) compound has more heat of hydrogenation than (i)

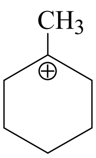
(t) (ii) compound has more degree of unsaturation than (i)

159. Column I

(a) 

(b) 

(c) 

(d) 

Column II

(p) Hyperconjugation

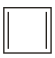
(q) All carbon atoms are sp^2-hybridised

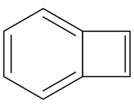
(r) Aromatic

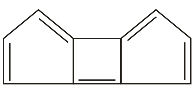
(s) Resonance

(t) Diamagnetic

160. Column I

(a) 

(b) 

(c) 

(d) C_8H_8

Column II

(p) Aromatic

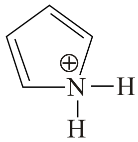
(q) Antiaromatic

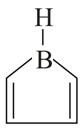
(r) Readily reacts with metal to form stable dianion

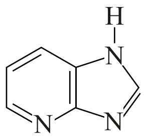
(s) Paramagnetic in nature due to presence of unpaired electrons in molecular orbitals

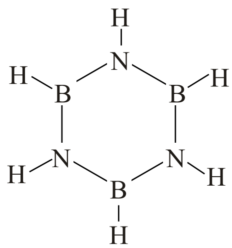
(t) Diamagnetic in nature due to presence of even electrons in molecular orbitals

161. Column I | **Column II**

(a) 

(b) 

(c) 

(d) 

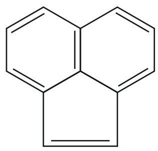
(p) Aromatic

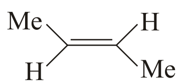
(q) Antiaromatic

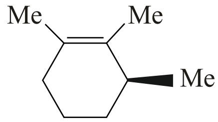
(r) Nonaromatic

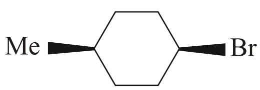
(s) Degree of unsaturation = 3

162. Column I (Reaction) | **Column II (Product)**

(a)  + D_2 (1 Eq.) $\xrightarrow{Ni}$ product

(b)  + Br_2 $\xrightarrow{CCl_4}$ product

(c)  $\xrightarrow[\text{II } Me_2S]{\text{I } O_3/CH_2Cl_2}$ product

(d)  $\xrightarrow[DMSO]{CH_3S^-Na^+}$ product

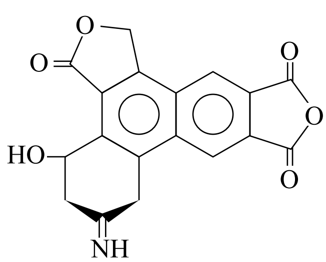
(p) Contains even chiral carbons

(q) Contains odd chiral carbon

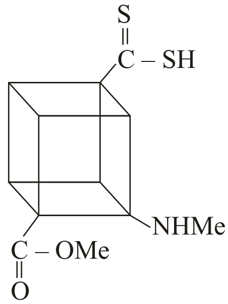
(r) Optically inactive

(s) Contains plane of symmetry

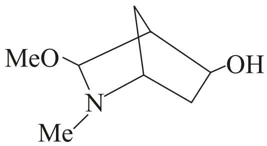
163. Column I | **Column II**

(a) 

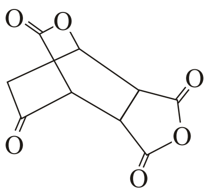
(p) Total number of functional groups in the compound is even. [excluding >C=C< bond]

(b) 

(q) Total number of functional groups in the compound is odd. [excluding >C=C< bond]

(c) 

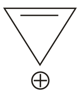
(r) Degree of unsaturation in the compound is even

(d) 

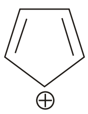
(s) Degree of unsaturation in the compound is odd

(t) Lactone is present as a functional group in the molecule

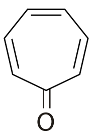
164. Column I | **Column II**

(a) 

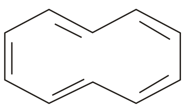
(p) Antiaromatic

(b) 

(q) Aromatic

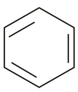
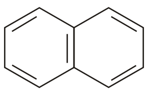
(c) 

(r) Nonaromatic

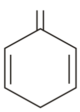
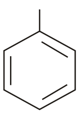
(d) 

(s) Degree of unsaturation (D.O.U) = 6

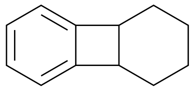
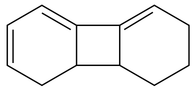
165. Column I (group) | **Column II (effect of group)**

(a)  and 

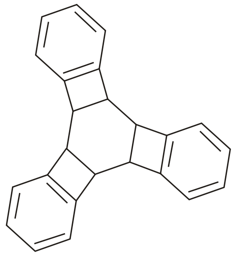
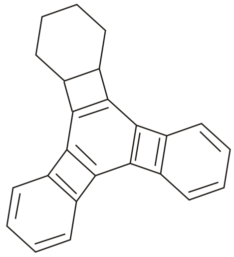
(p) Ist compound has more heat of hydrogenation than the IInd

(b)  and 

(q) Ist compound has more resonance energy than the IInd

(c)  and 

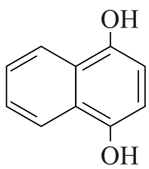
(r) Ist compound is more stable than the IInd

(d)  and 

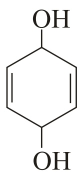
(s) IInd compound has more heat of combustion than the Ist

(t) IInd compound has more degree of unsaturation than the Ist

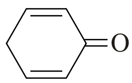
166. Column I (compound) **Column II (relationship)**

(a) 

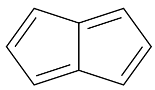
(p) Aromatic

(b) 

(q) Nonaromatic

(c) 

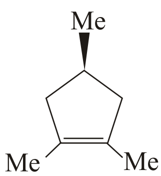
(r) Dipolemoment is nonzero

(d) 

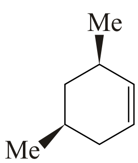
(s) Antiaromatic

(t) Dipolemoment is zero

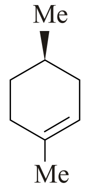
167. Column I **Column II**

(a) 

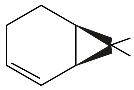
(p) Compound which is optically active

(b) 

(q) Compound which is optically inactive due to the presence of plane of symmetry and gives optically inactive hydrogenation product (major product)

(c) 

(r) Compound which is optically active but gives optically inactive hydrogenation product (major product) with 1 equivalent of H_2 and metal

(d) 

(s) Degree of unsaturation in compound = 2

(t) Compound which give optically active product on ozonolysis

Integer Type

168. From the following compounds/ions:

(a) $\overset{\oplus}{C}H_3$ (b) $\overset{\oplus}{N}H_4$ (c) BF_3 (d) NH_3 (e) $NH_2–NH_2$

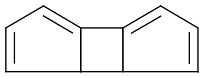
(f) PCl_3 (g) PCl_5 (h) $SbCl_5$ (i) $GaCl_3$ (j) $AlCl_3$

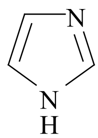
(k) F^- (l) $\overset{\ominus}{C}N$ (m) $CH_3–Cl$ [“C” atom of halide]

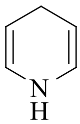
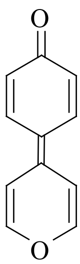
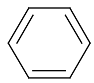
Identify value of “X”.

Where “X” is the total number of $E^{\oplus}$/electrophiles.

169. From the following compound

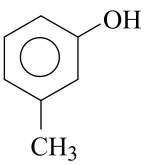
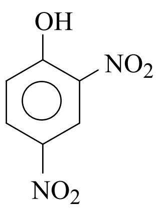
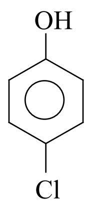
(a)  (b) $C_{14}H_{14}$ (c) C_8H_8 [COT]

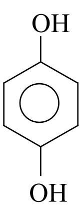
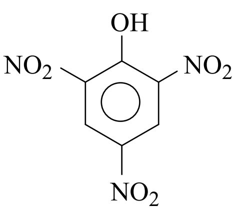
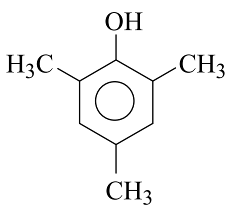
(d) $C_4H_4^{-2}$ (e) $C_4H_4^{+}$ (f) 

(g)  (h)  (i) 

Identify the total number of aromatic compounds.

170. The following compounds are phenol derivative

(a)  (b)  (c) 

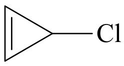
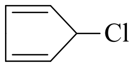
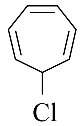
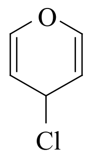
(d)  (e)  (f) 

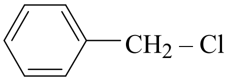
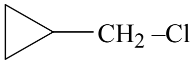
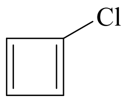
If number of phenol derivative = x.

Number of phenol derivative gives +ve test with $NaHCO_3$ = y.

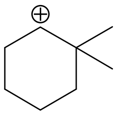
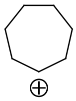
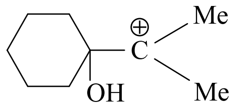
Then, find value of x + y.

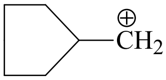
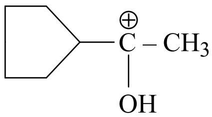
171. How many products will be aromatic ion when $AgNO_3$ reacts with the following compounds?

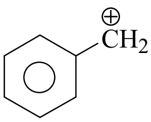
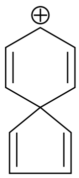
(a) 
(b) 
(c) 
(d) 

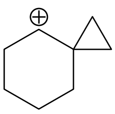
(e) 
(f) 
(g) 
(h) $H-C\equiv C-Cl$

172. How many carbocations undergo rearrangements?

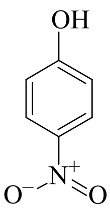
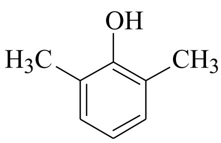
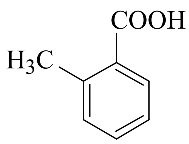
(i) 
(ii) 
(iii) 

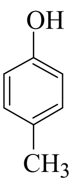
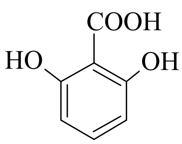
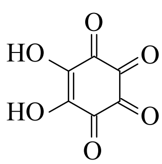
(iv) 
(v) 
(vi) $Me_3C-CH_2-\overset{\oplus}{C}H_2$

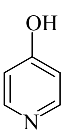
(vii) 
(viii) $CH_2=\overset{\oplus}{C}H$
(ix) 

(x) 
(xi) $CH_2=CH-\overset{+}{C}H_2$
(xii) $Ph_2HC-\overset{+}{C}Me_2$

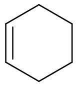
173. How many compounds are soluble in aqueous NaHCO3?

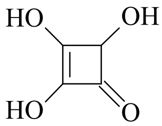
(a) 
(b) 
(c) 

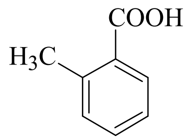
(d) 
(e) 
(f) 

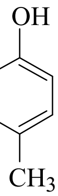
(g) 
(h) $H-C\equiv C-H$

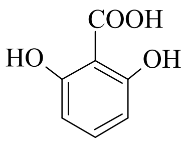
174. How many compounds are soluble in aqueous NaOH?

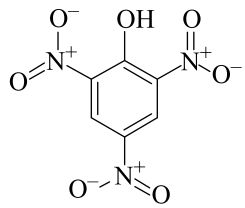
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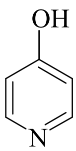
(b) 

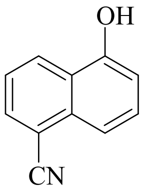
(c) 

(d) 

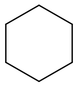
(e) 

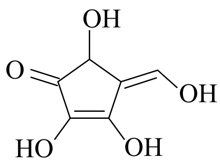
(f) 

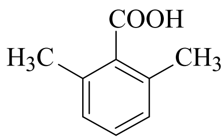
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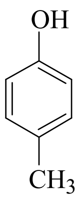
(h) 

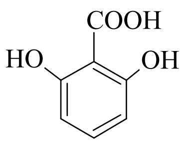
175. How many compounds liberate hydrogen gas on reaction with Na metal?

(a) 

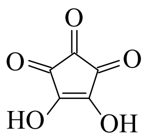
(b) 

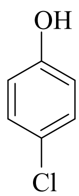
(c) 

(d) 

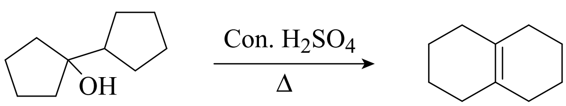
(e) 

(f) CH_4

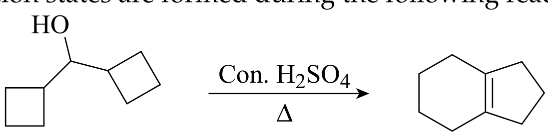
(g) 

(h) 

176. How many transition states are formed during the following reaction?



177. How many transition states are formed during the following reaction?



Answer Keys

LEVEL 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
d	c	d	a	a	d	b	c	d	a	c	d	d	a	a
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
b	c	d	b	b	a	b	d	a	d	a	c	a	d	d
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
b	d	a	b	d	b	a	c	d	c	d	c	c	a	bc
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
d	ac	b	c	a	a	a	c	b	b	c	a	a	b	c
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
b	d	c	b	b	a	c	d	b	d	d	a	d	c	a
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
c	b	b	c	cd	c	a	c	b	d	b	b	d	d	a
91	92	93	94											
c	a	a	c											

LEVEL 2

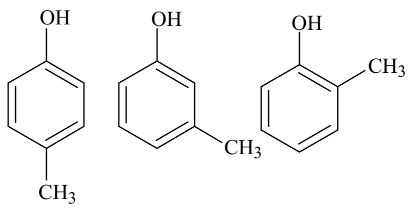
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
c	d	b	d	a	b	b	c	b	c	b	c	a	abcd	b
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
d	a	b	c	b	b	a	b	b	d	a	d	c	a	c
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
a	a	a	b	d	a	a	c	a	a	d	b	d	b	a
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
a	a	a	b	c	b	b	a	a	a	b	b	c	a	d
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
d	c	d	d	c	a	d	b	c	c	c	a	d	a	a
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
a	b	d	a	b	b	a	a	c	b	a	a	c	d	bcd
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
ab	abc	abd	abcd	bcd	abd	bc	b	bcd	d	abc	ac	acd	cd	bc
106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
ad	abc	bd	bcd	bc	acd	bc	b	bc	bc	c	ab	abcd	acd	acd

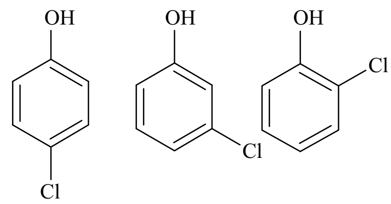
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ab	abc	acd	abcd	abd	bc	abc	abcd	d	a	a	b	d	c	a
136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
d	c	a	d	c	c	b	b	a	ad	cd	d	ad	d	c
151	152	153	154	155	156	157(a)	157(b)	157(c)	157(d)	158(a)	158(b)	158(c)	158(d)	159(a)
a	b	c	d	d	a	q	qs	qr	pt	p	p	qrs	st	qrst
159(b)	159(c)	159(d)	160(a)	160(b)	160(c)	160(d)	161(a)	161(b)	161(c)	161(d)	162(a)	162(b)	162(c)	162(d)
qrst	qrst	p	qrs	qrs	pt	r	rs	qs	p	p	prs	prs	q	rs
163(a)	163(b)	163(c)	163(d)	164(a)	164(b)	164(c)	164(d)	165(a)	165(b)	165(c)	165(d)	166(a)	166(b)	166(c)
pst	qs	qr	qst	q	p	p	rs	rst	p	qrs	qrs	pr	qr	qr
166(d)	167(a)	167(b)	167(c)	167(d)	168	169	170	171	172	173	174	175	176	177
rs	qs	prs	prst	prst	8	5	8	4	8	4	7	6	5	7

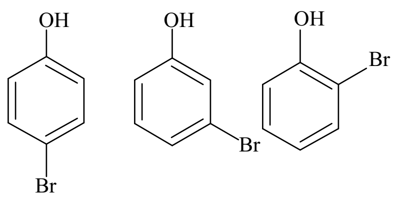
WORKBOOK EXERCISES

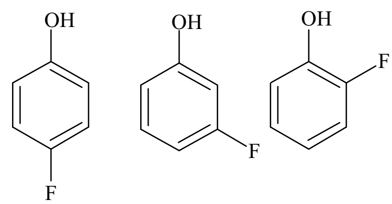
EXERCISE 1

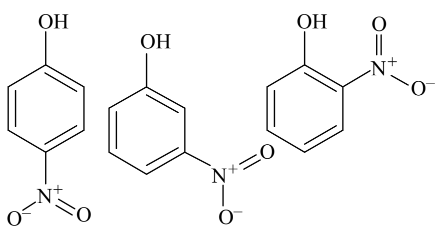
Correct Acidic Strength of Compounds

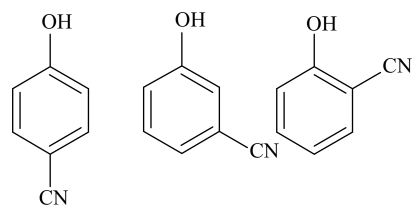
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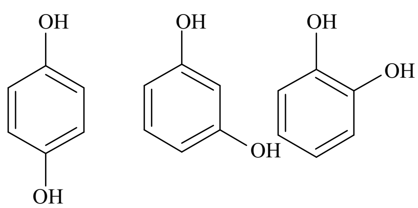
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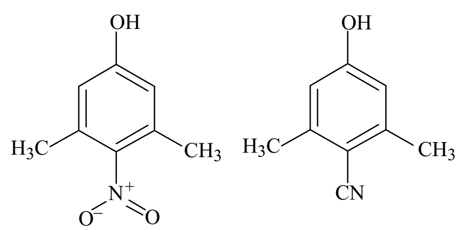
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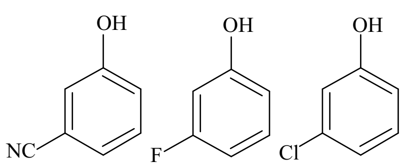
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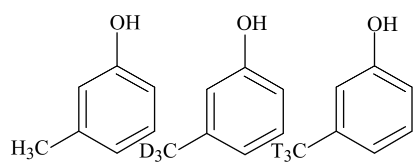
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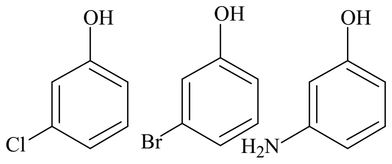
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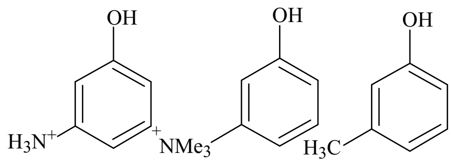
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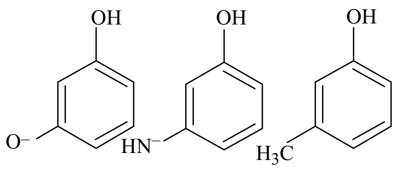
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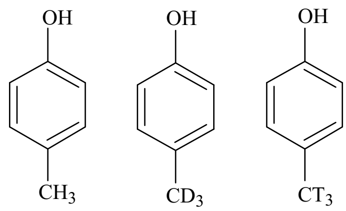
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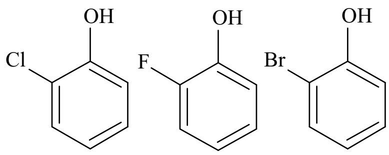
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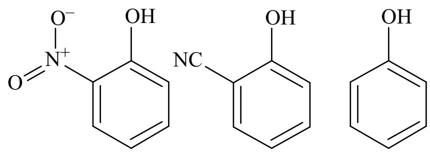
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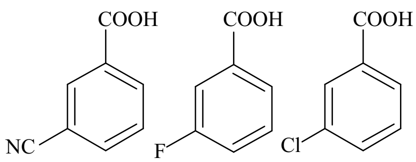
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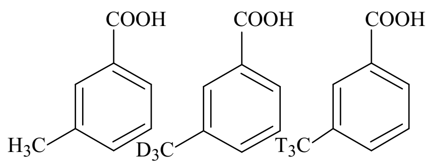
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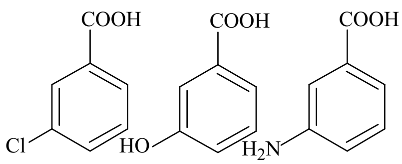
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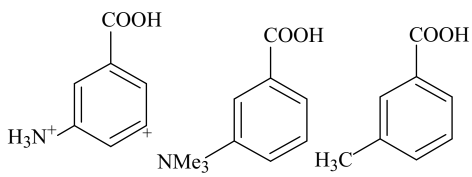
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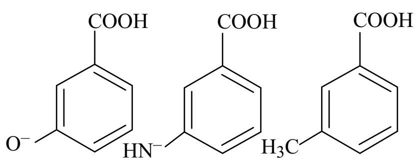
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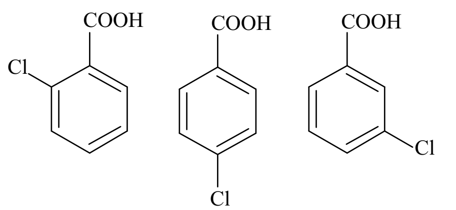
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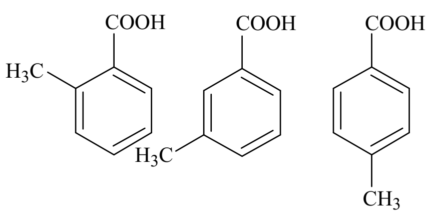
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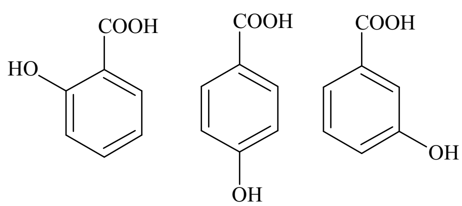
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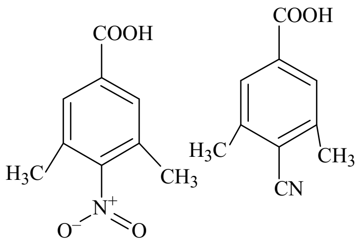
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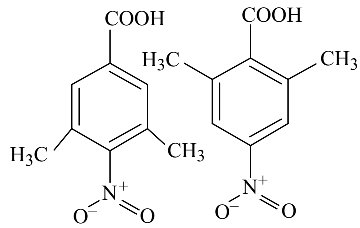
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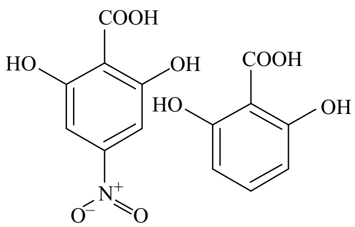
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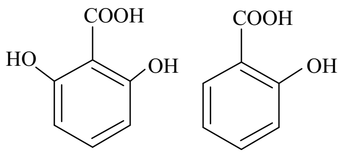
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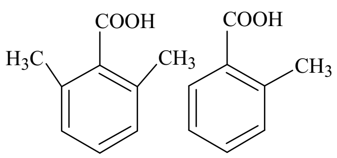
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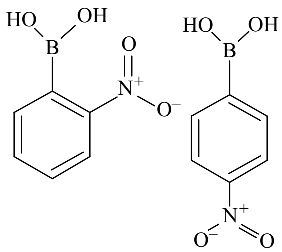
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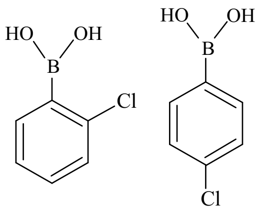
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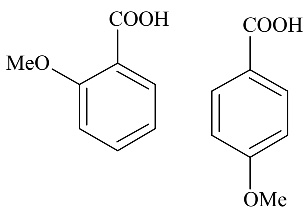
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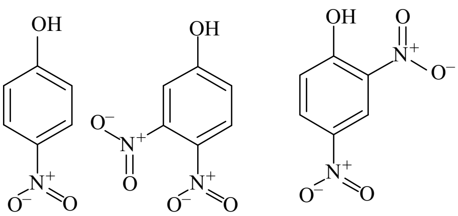
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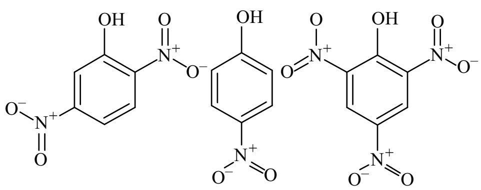
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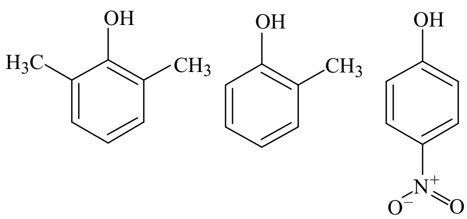
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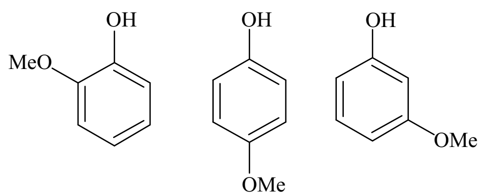
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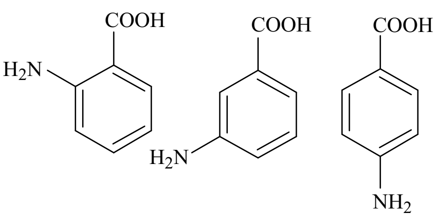
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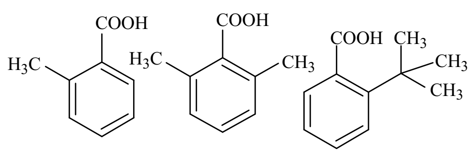
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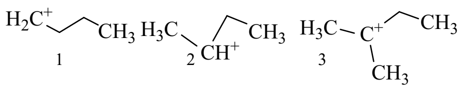


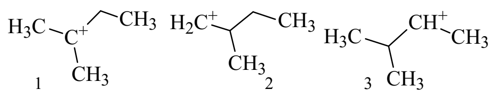
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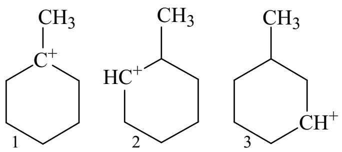


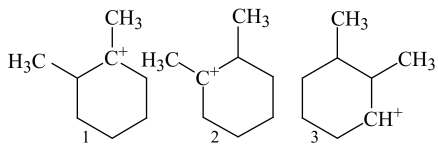
EXERCISE 2

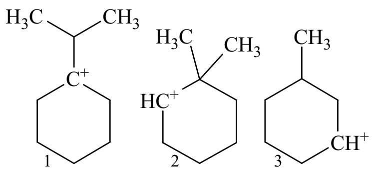
Correct Carbocation Stability Order

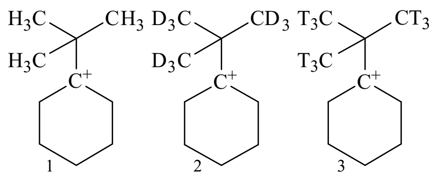
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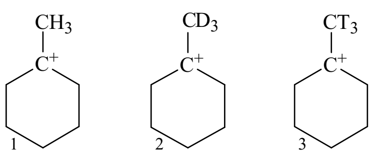
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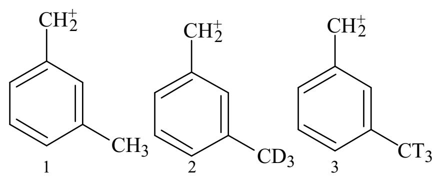
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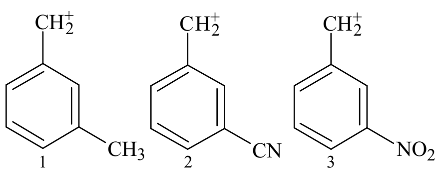
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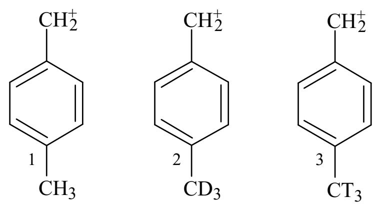
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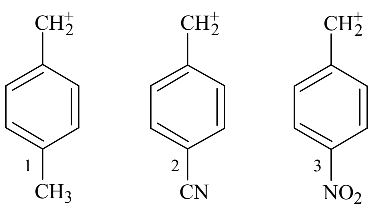
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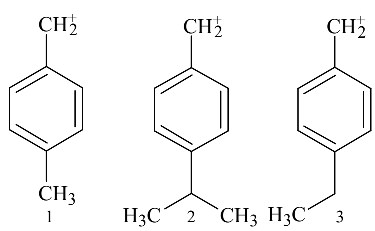
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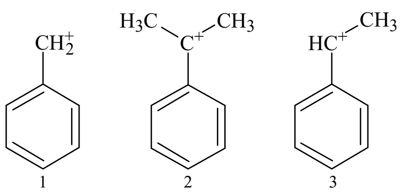
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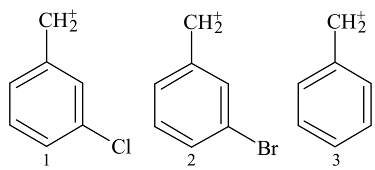
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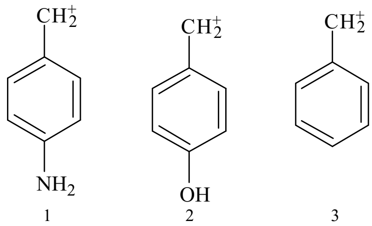
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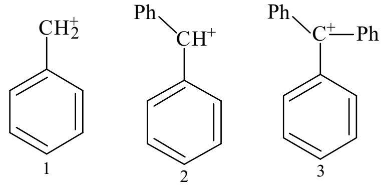
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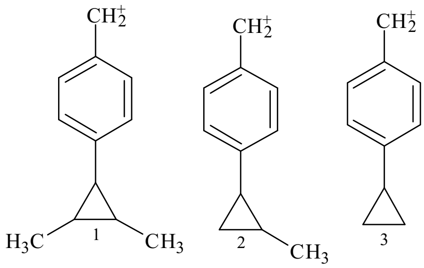
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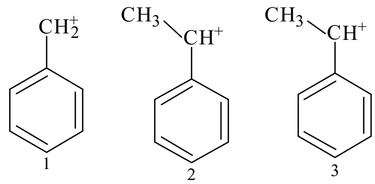
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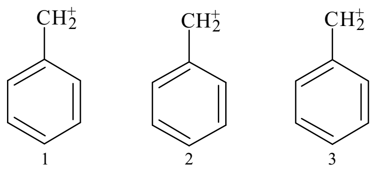
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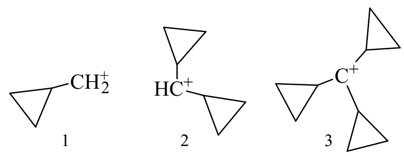
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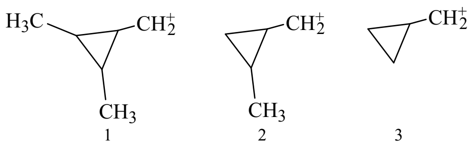
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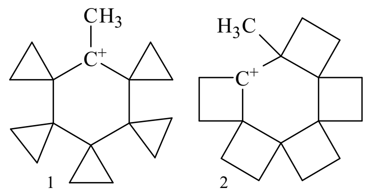
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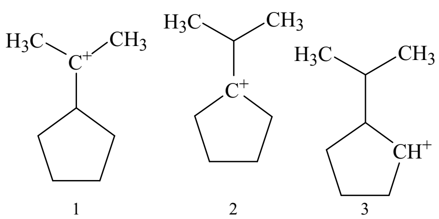
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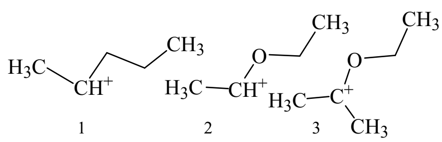
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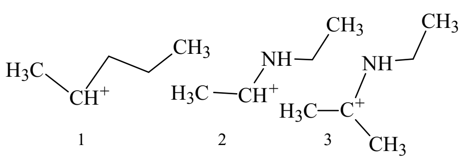
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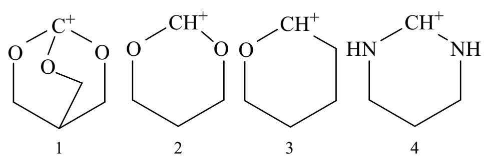
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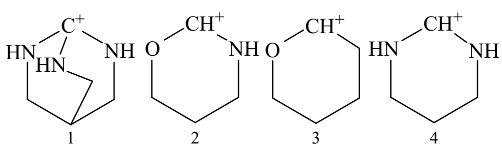
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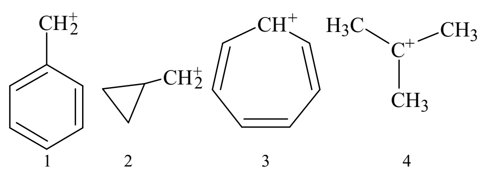
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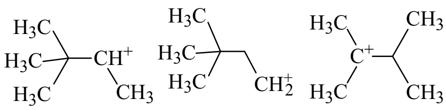
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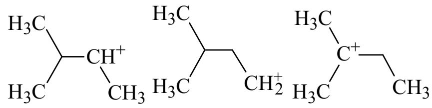
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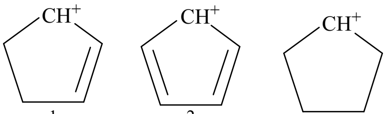
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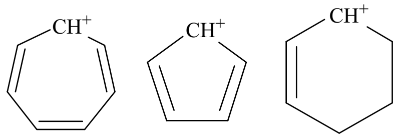
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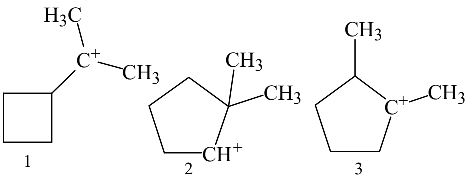
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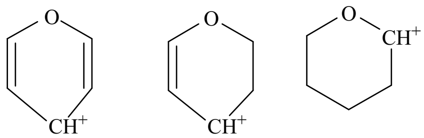
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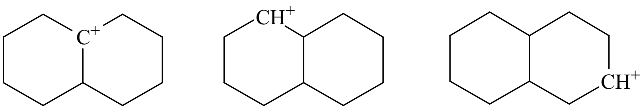
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1 2 3

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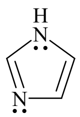
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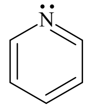
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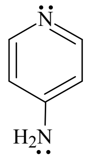
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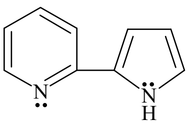
EXERCISE 3

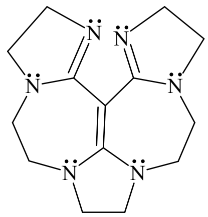
Identify localised and delocalised lp in the following examples

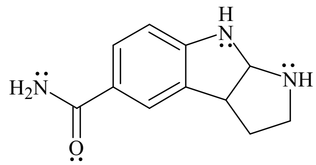
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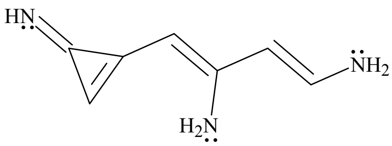
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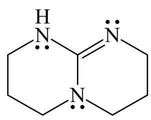
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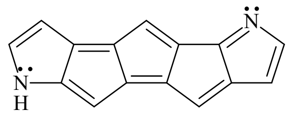
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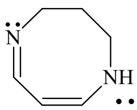
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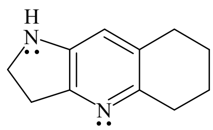
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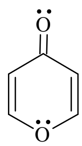
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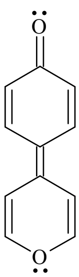
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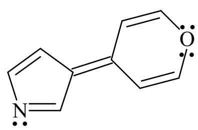
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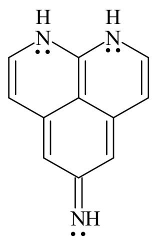
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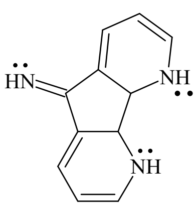
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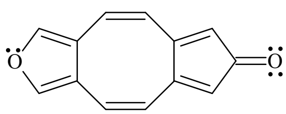
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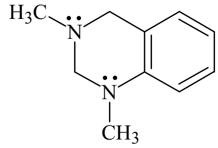
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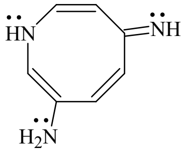
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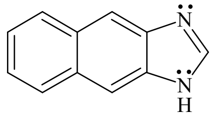
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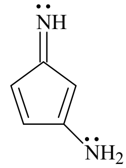
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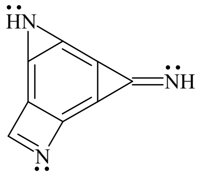
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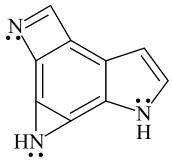
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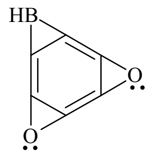
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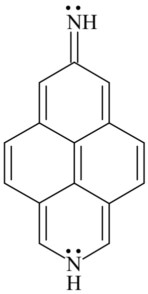
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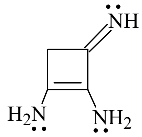
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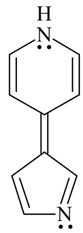
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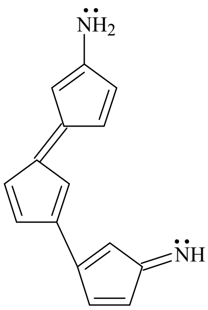
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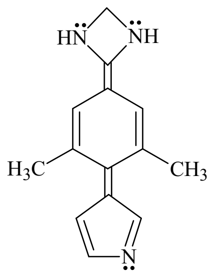
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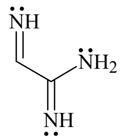
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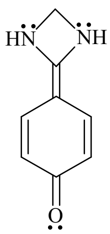
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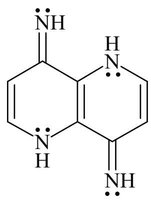
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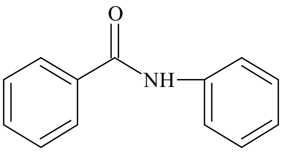
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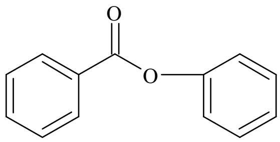
EXERCISE 4

Identify the site of electrophilic attack at benzene ring

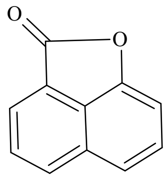
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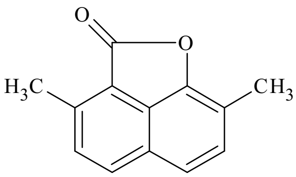
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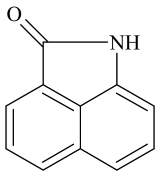
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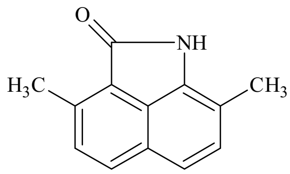
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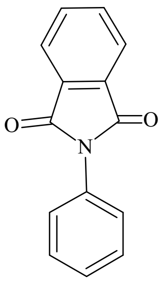
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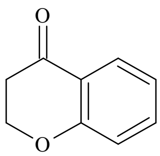
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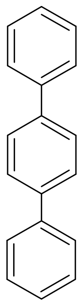
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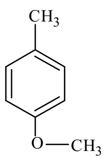
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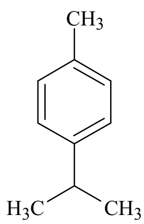
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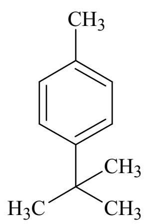
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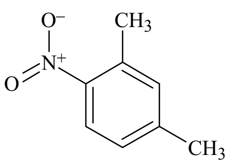
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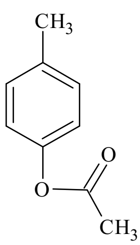
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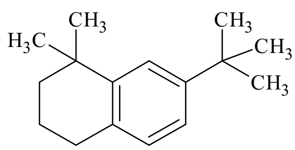
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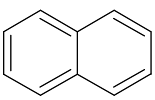
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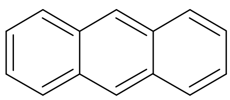
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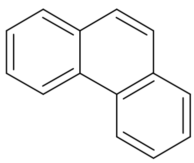
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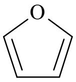
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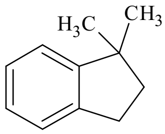
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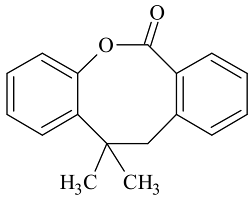
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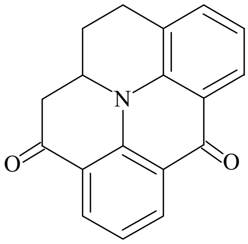
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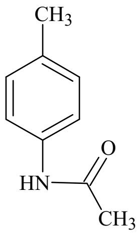
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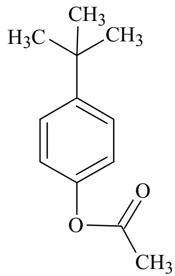
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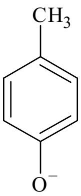
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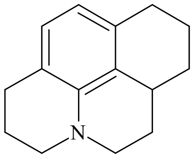
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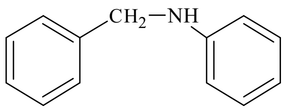
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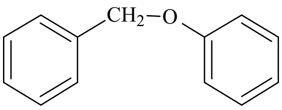
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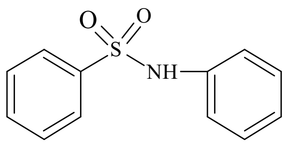
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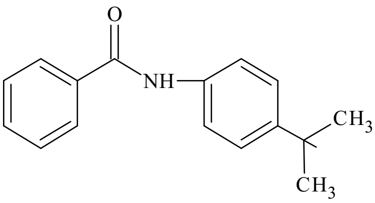
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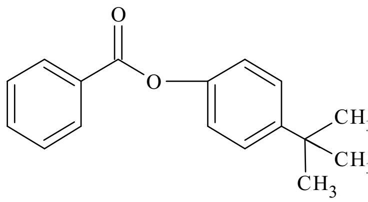
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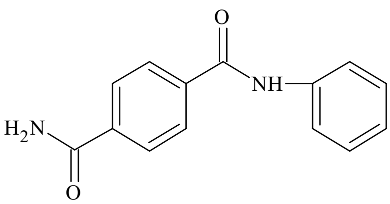
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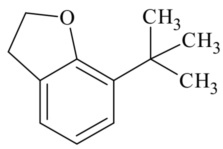
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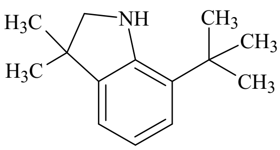
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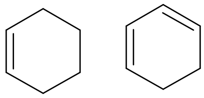


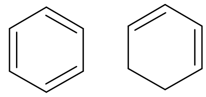
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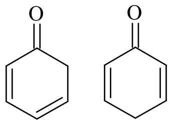


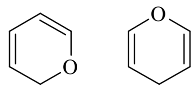
EXERCISE 5

Identify the correct order of resonance energy for the following pairs of compounds

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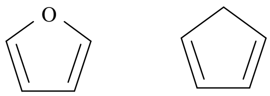
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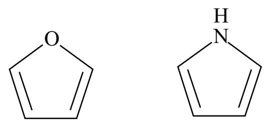
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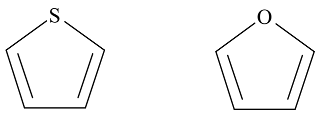
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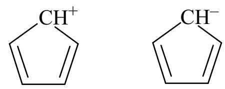
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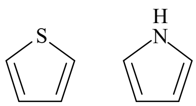
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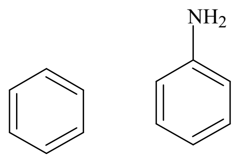
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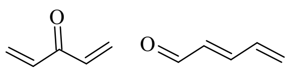
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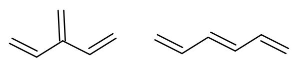
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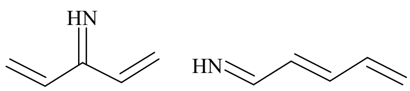
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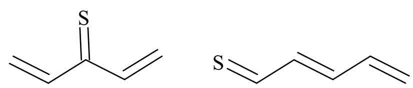
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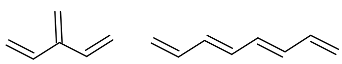
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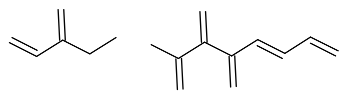
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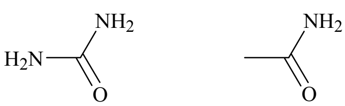
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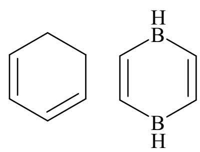
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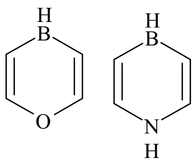
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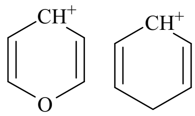
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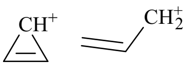
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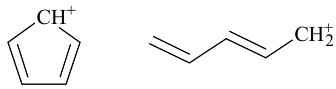
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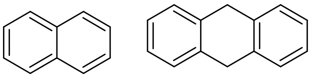
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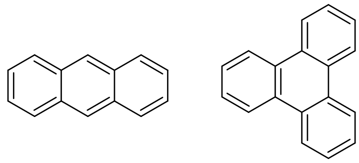
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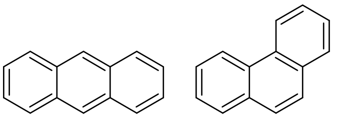
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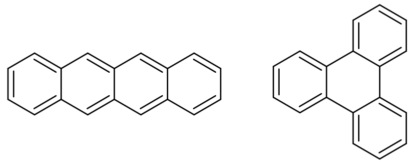
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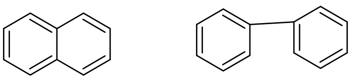
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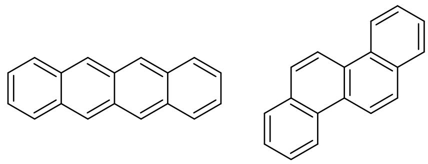
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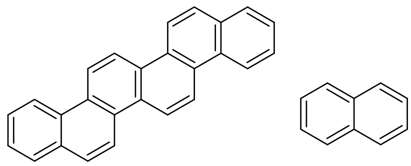
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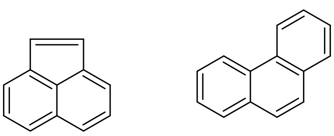
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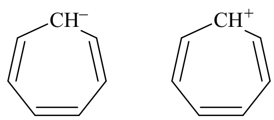
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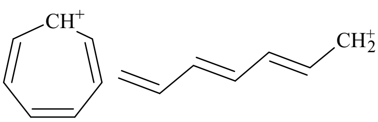
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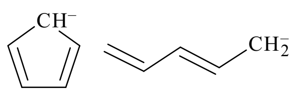
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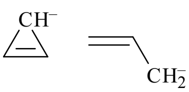
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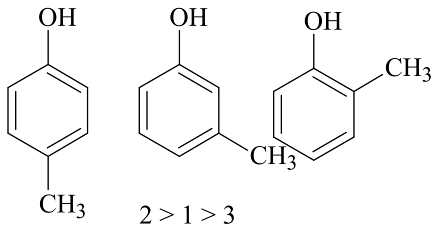
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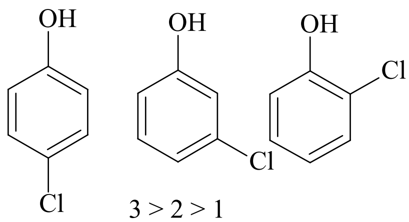
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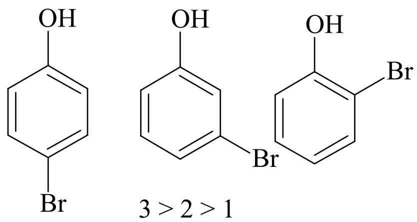
SOLUTION FOR WORKBOOK EXERCISES

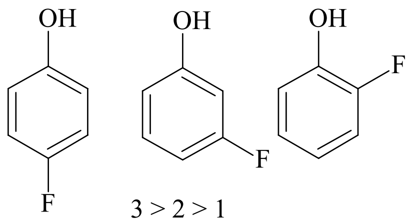
EXERCISE 1

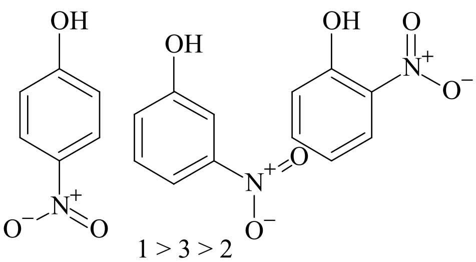
Acidic Strength of Compounds

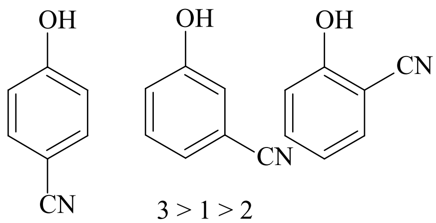
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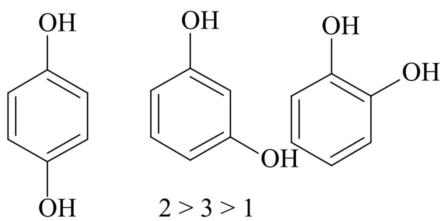
2.

$3 > 2 > 1$

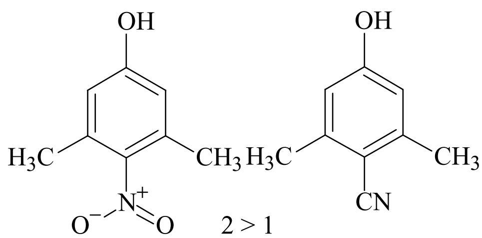
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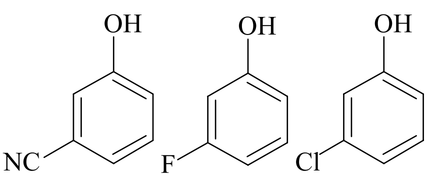
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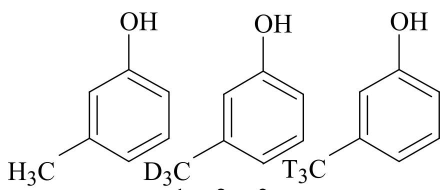
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$1 > 3 > 2$

6.

$3 > 1 > 2$

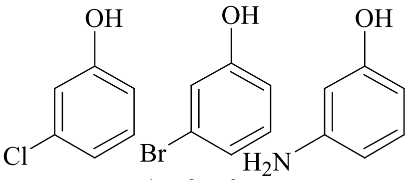
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$2 > 3 > 1$

8.

$2 > 1$

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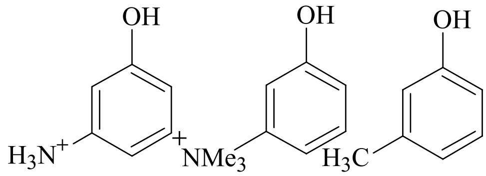
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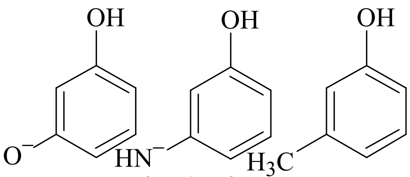
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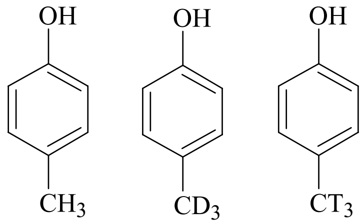
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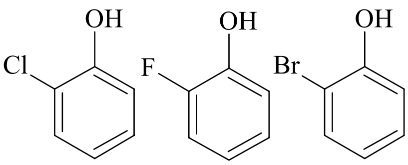
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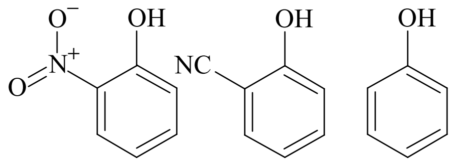
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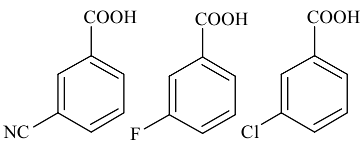


2 > 1 > 3

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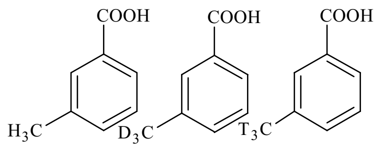


17.



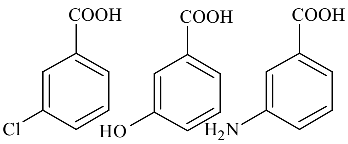
1 > 2 > 3

18.



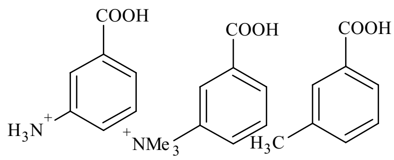
1 > 2 > 3

19.



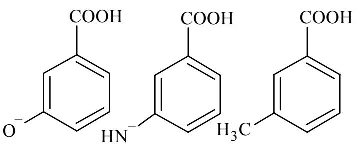
1 > 2 > 3

20.



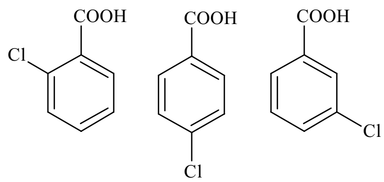
2 > 1 > 3

21.



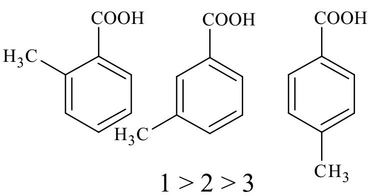
3 > 1 > 2

22.



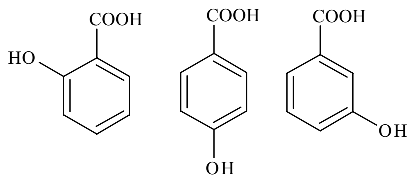
1 > 3 > 2

23.

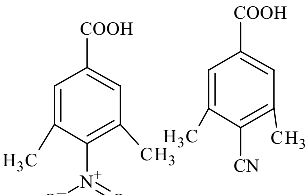


1 > 2 > 3

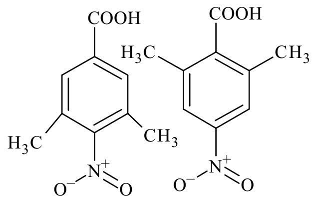
24.



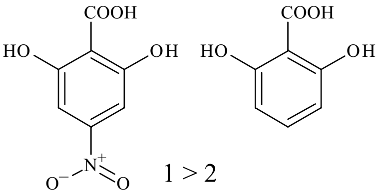
1 > 3 > 2

25. 

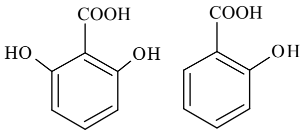
2 > 1

26. 

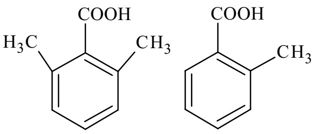
2 > 1

27. 

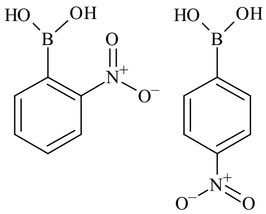
1 > 2

28. 

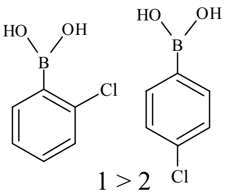
1 > 2

29. 

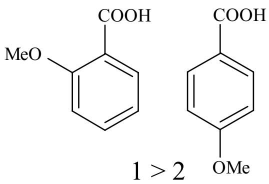
1 > 2

30. 

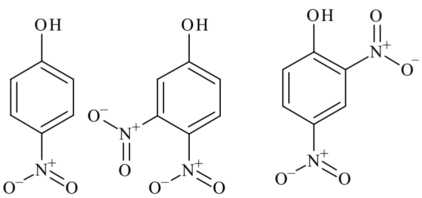
2 > 1

31. 

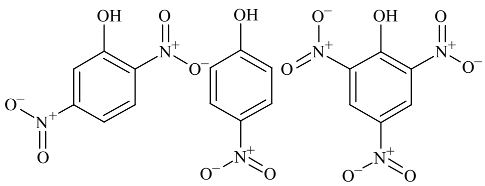
1 > 2

32. 

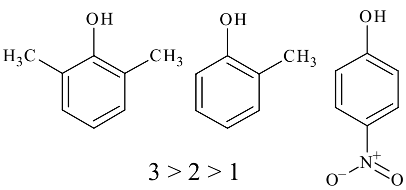
1 > 2

33. 

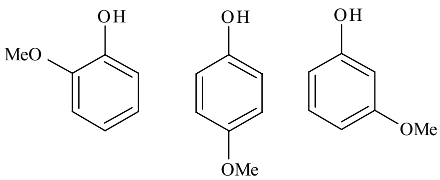
3 > 2 > 1

34. 

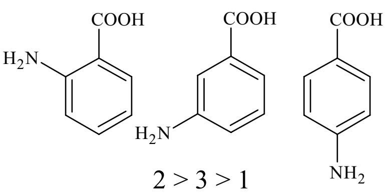
3 > 1 > 2

35. 

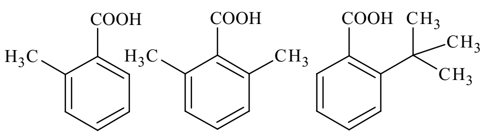
3 > 2 > 1

36. 

3 > 1 > 2

37. 

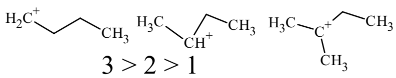
2 > 3 > 1

38. 

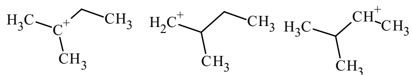
2 > 3 > 1

EXERCISE 2

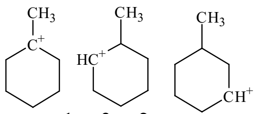
Carbocation Stability order

1. 

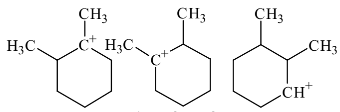
$3 > 2 > 1$

2. 

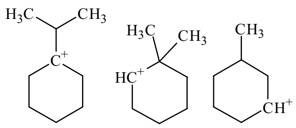
$1 > 3 > 2$

3. 

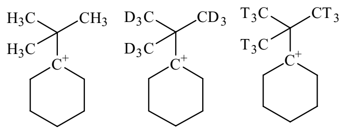
$1 > 3 > 2$

4. 

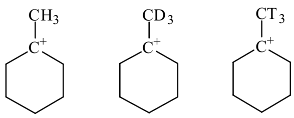
$1 = 2 > 3$

5. 

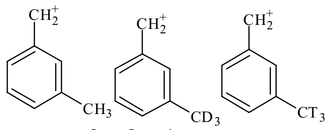
$1 > 3 > 2$

6. 

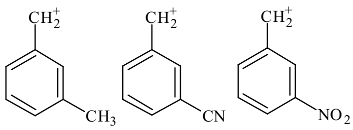
$3 > 2 > 1$

7. 

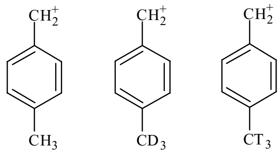
$1 > 2 > 3$

8. 

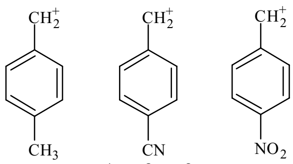
$3 > 2 > 1$

9. 

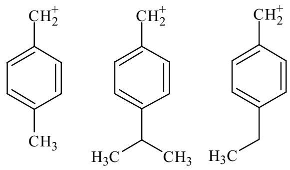
$1 > 2 > 3$

10. 

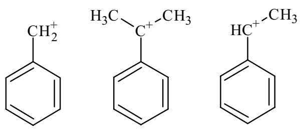
$1 > 2 > 3$

11. 

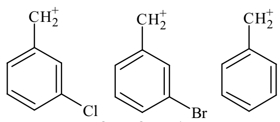
$1 > 2 > 3$

12. 

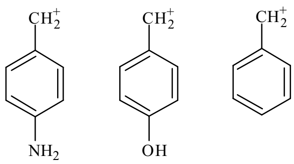
$1 > 3 > 2$

13. 

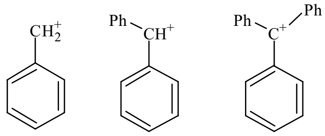
$2 > 3 > 1$

14. 

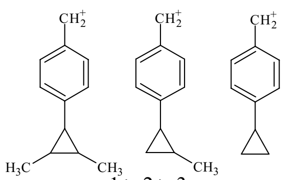
$3 > 2 > 1$

15. 

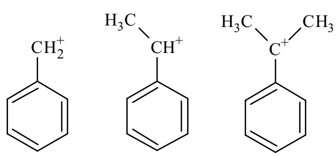
$1 > 2 > 3$

16. 

$3 > 2 > 1$

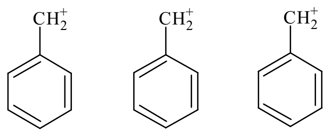
17. 

$1 > 2 > 3$

18. 

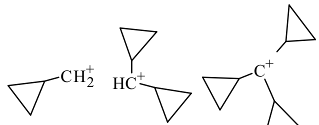
$3 > 2 > 1$

19.



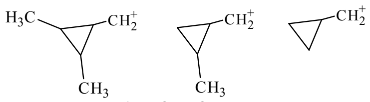
same stability

20.



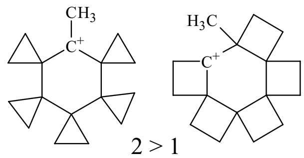
3 > 2 > 1

21.



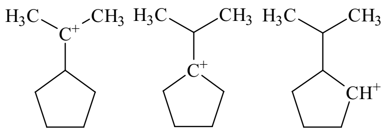
1 > 2 > 3

22.



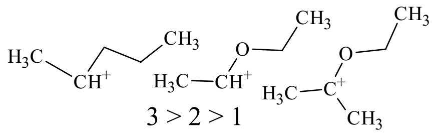
2 > 1

23.



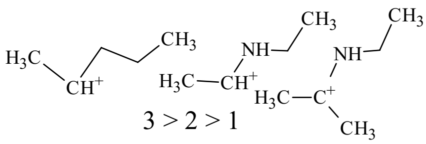
1 > 2 > 3

24.



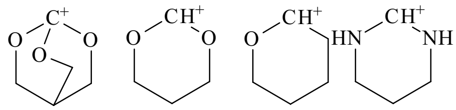
3 > 2 > 1

25.



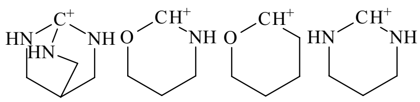
3 > 2 > 1

26.



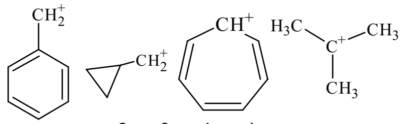
4 > 2 > 3 > 1

27.



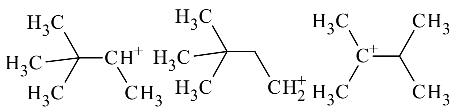
4 > 2 > 3 > 1

28.



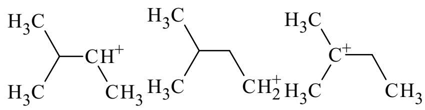
2 > 3 > 1 > 4

29.



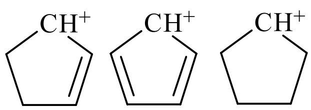
3 > 1 > 2

30.



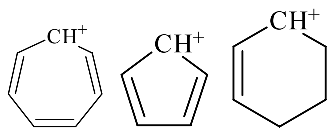
3 > 1 > 2

31.



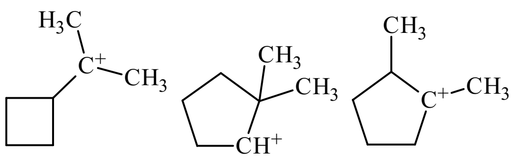
1 > 3 > 2

32.



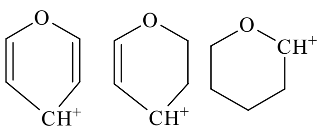
1 > 3 > 2

33.



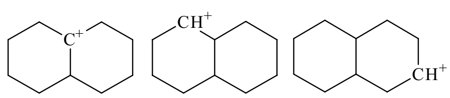
3 > 2 > 1

34.



1 > 2 > 3

35.

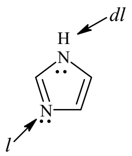


1 > 3 > 2

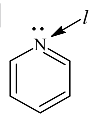
EXERCISE 3

Identify localised and delocalised 1p in the following examples

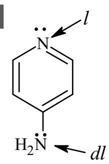
1.



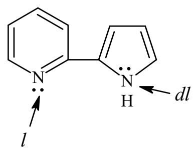
2.



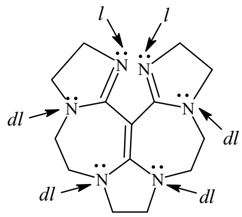
3.



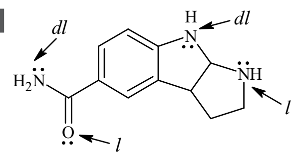
4.



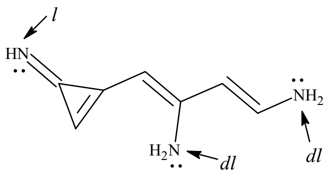
5.



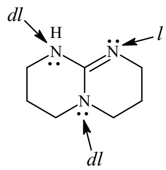
6.



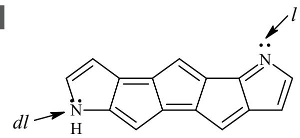
7.



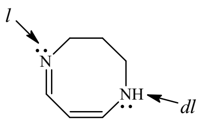
8.



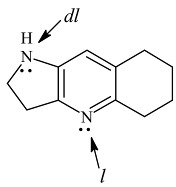
9.



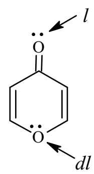
10.



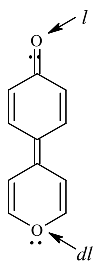
11.



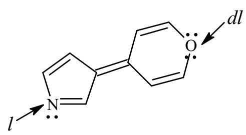
12.



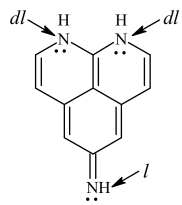
13.



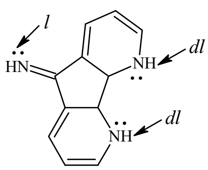
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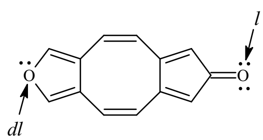
15.



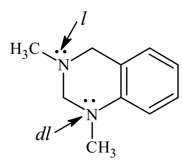
16.



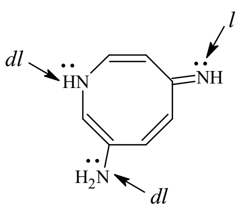
17.



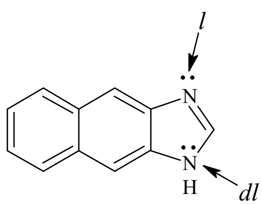
18.



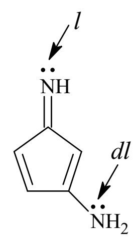
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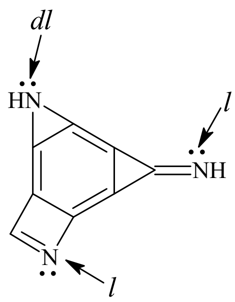
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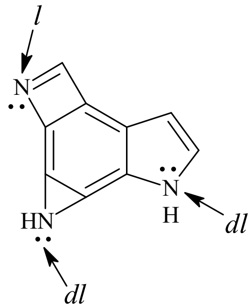
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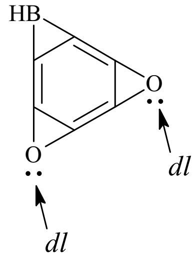
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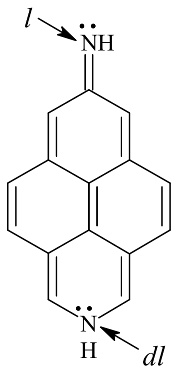
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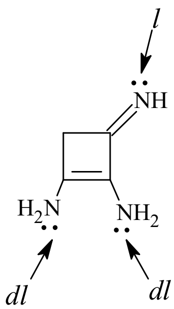
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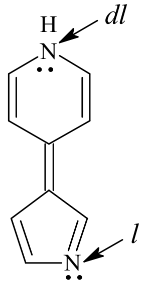
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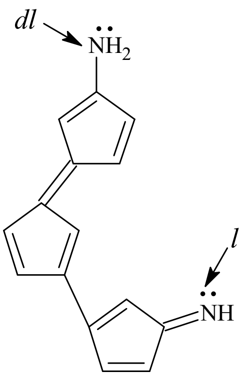
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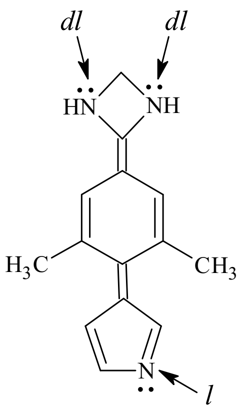
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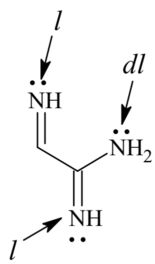
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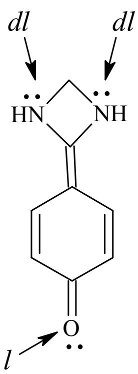
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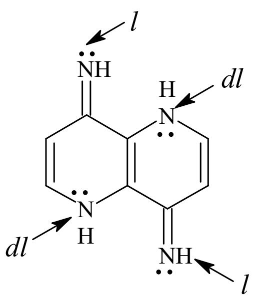
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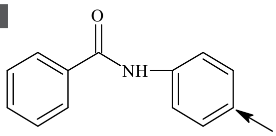
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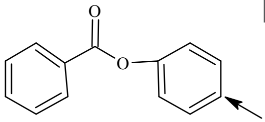
EXERCISE 4

Identify the site of electrophilic attack at benzene ring

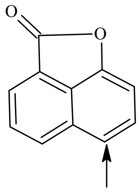
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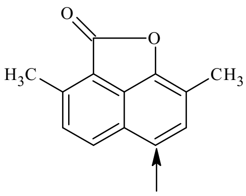
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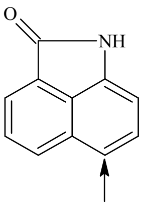
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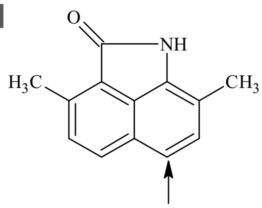
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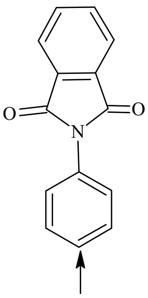
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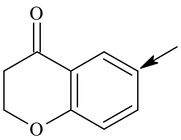
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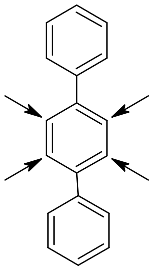
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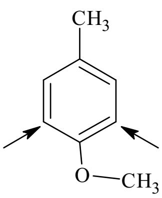
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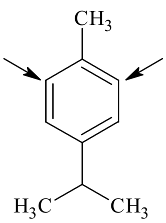
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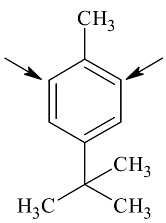
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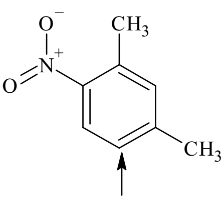
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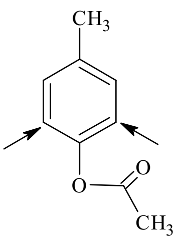
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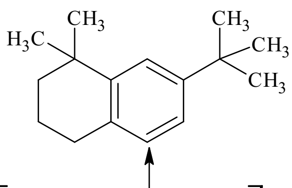
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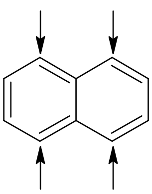


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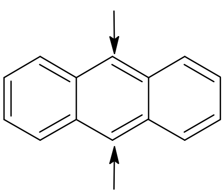


[Note : Major attack represents b arrow (→)]

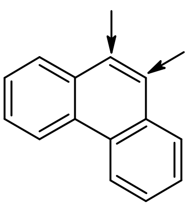
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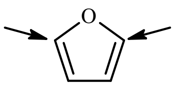
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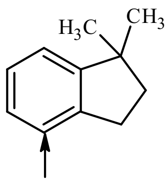
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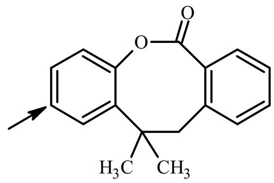
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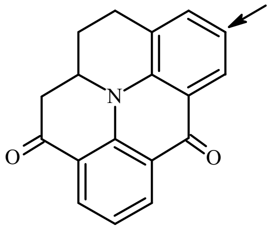
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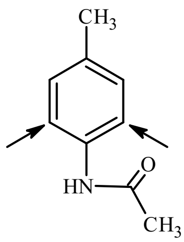
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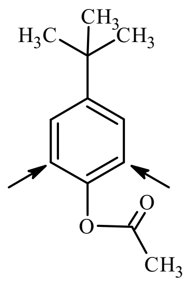
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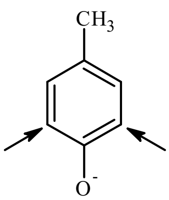
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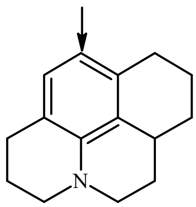
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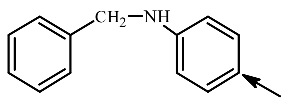
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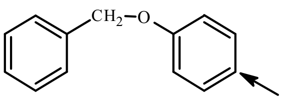
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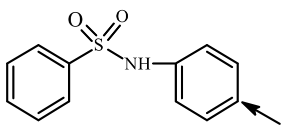
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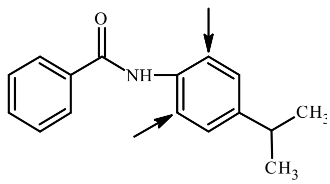
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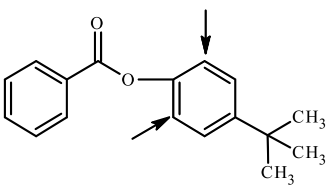
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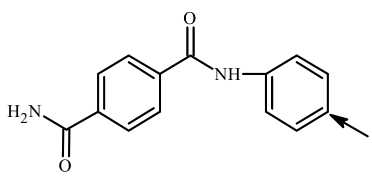
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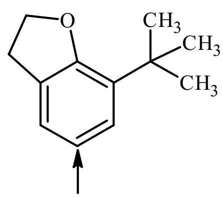
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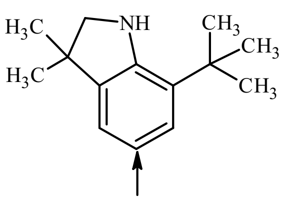
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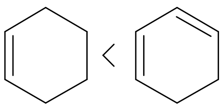


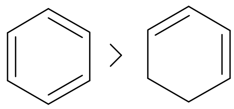
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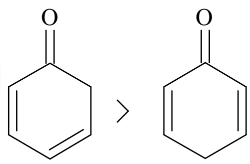


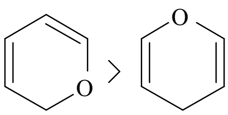
EXERCISE 5

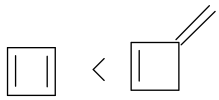
Identify the correct order of resonance energy for the following pairs of compounds

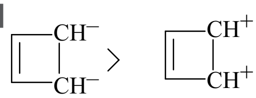
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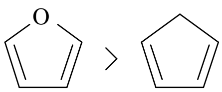
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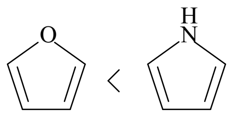
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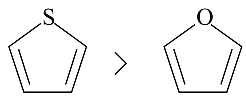
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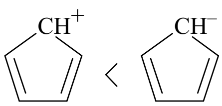
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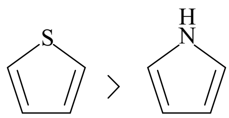
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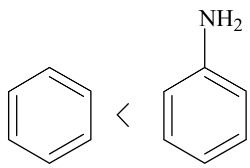
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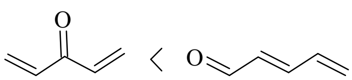
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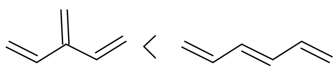
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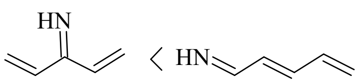
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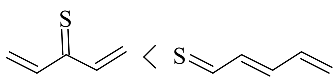
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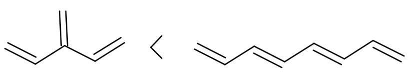
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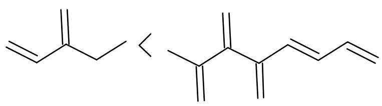
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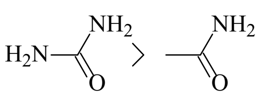
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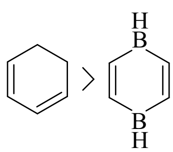
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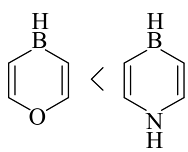
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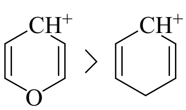
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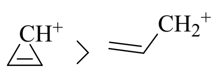
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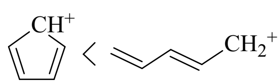
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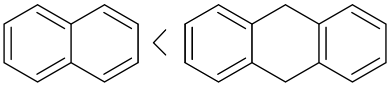
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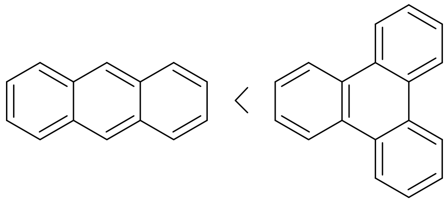
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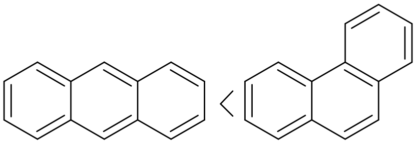
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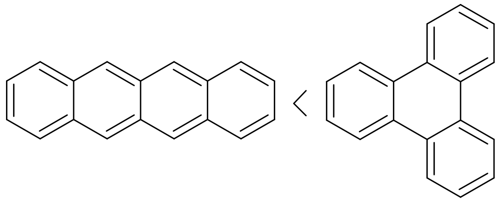
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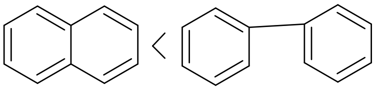
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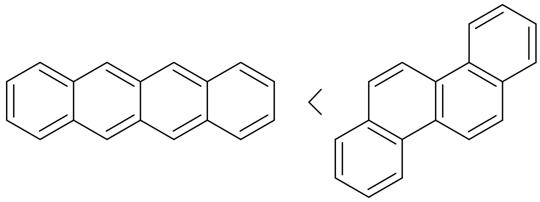
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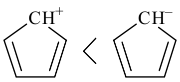
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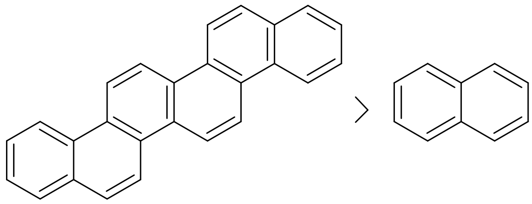
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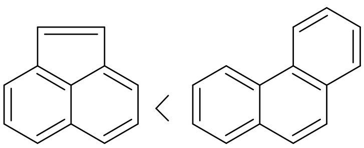
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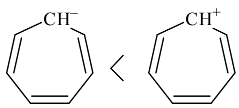
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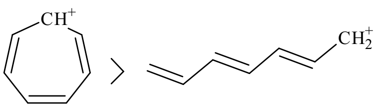
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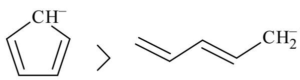
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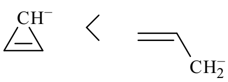
32. 

33. 

34. 

35. 

36. 

37. 

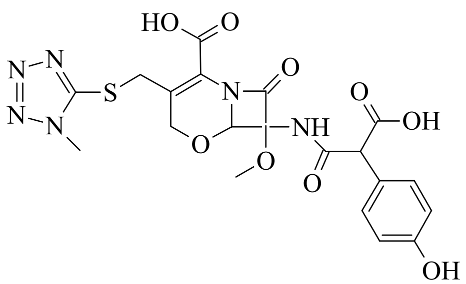
CHAPTER 2

Isomerism

Question Bank

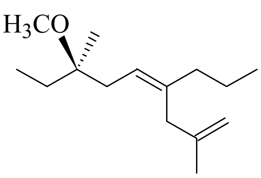
LEVEL 1

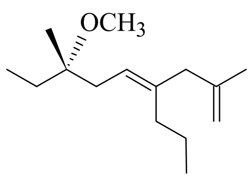
1. How many stereocenters does latomoxef (an oxacephem antibiotic) have?

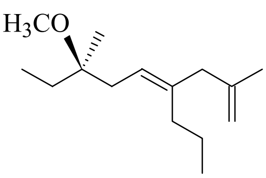


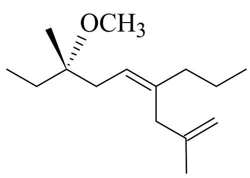
(a) 2 (b) 3 (c) 4 (d) 5

2. Which molecule is (R, Z)-7-methoxy-2, 7-dimethyl-4-propylnona-1, 4-diene?

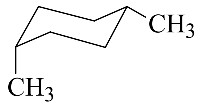
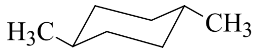
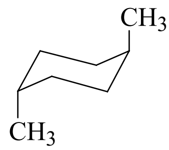
(a) 

(b) 

(c) 

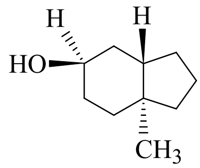
(d) 

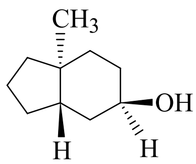
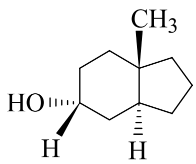
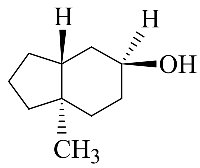
3. Choose the correct order that has the following compounds correctly arranged with respect tothermodynamic stability.

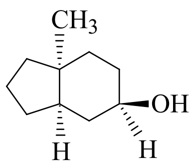
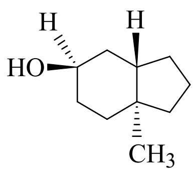
(i)  (ii)  (iii) 

(a) ii < i < iii (b) i < ii < ii (c) i < iii < i (d) iii < i < ii

4. Which of the structures below is a diastereomer of A?



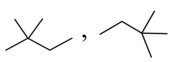
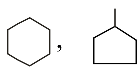
(i)  (ii)  (iii) 

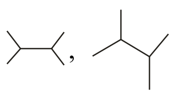
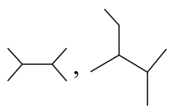
(iv)  (v) 

(a) i (b) iii (c) ii and iv (d) iv

5. The total number of structural isomers of $C_4H_{11}N$ would be
(a) 4 (b) 8 (c) 5 (d) 10

6. Which of the following pair is the chain isomer?

(a)  (b) 

(c)  (d) 

7. How many geminal dichloride with different formula are possible for $C_3H_6Cl_2$?
(a) only one (b) two (c) three (d) four

8. What is the relation between 3-ethylpentane and 3-methylhexane?
(a) Chain isomers (b) Position isomers
(c) Functional isomers (d) Metamers

9. How many isomers are possible for methyl anthracene?
(a) 2 (b) 3 (c) 4 (d) 5

10. The compounds $(CH_3)_3N$ and $CH_3CH_2CH_2NH_2$ represent
(a) chain isomerism (b) position isomerism
(c) functional isomerism (d) all of the above

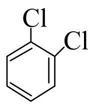
11. An isomer of ethanol is

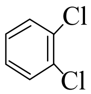
(a) methanol (b) acetone
(c) diethyl ether (d) dimethyl ether

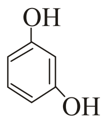
12. The number of primary, secondary and tertiary amines possible with the molecular formula C_3H_9N respectively

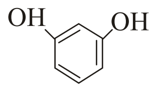
(a) 1, 2, 2 (b) 1, 2, 1 (c) 2, 1, 1 (d) 3, 0, 1

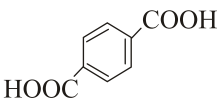
13. Examine the relation between the following pairs of compounds

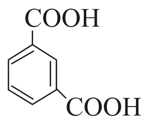
(i) 

and 

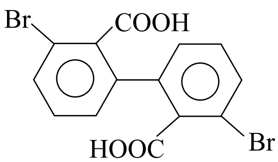
(ii) 

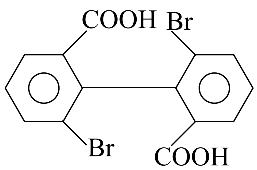
and 

(iii) 

and 

(a) All i, ii, iii are identical
(b) All i, ii, iii are isomers
(c) i, ii are identical, iii is isomer
(d) i is identical and ii, iii are isomers

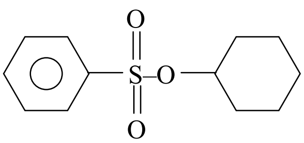
14. 

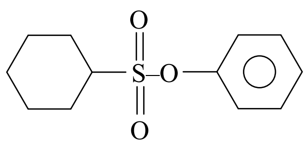
and 

are

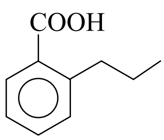
(a) Positional (b) Chain (c) Geometrical (d) Functional

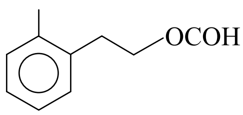
15. Given compound shows which type of isomerism?



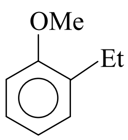
and 

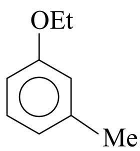
(a) Chain isomerism (b) Positional isomerism
(c) Metamerism (d) Functional group isomerism

16. 

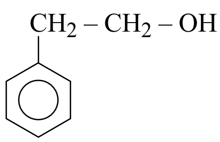
and 

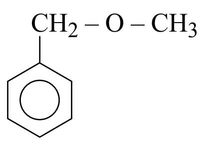
Functional isomers



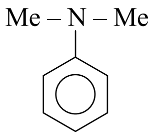
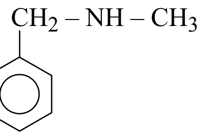
and 

Metamers



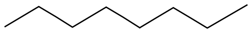
and 

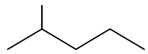
Metamers

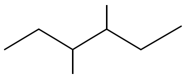
 and  Functional isomers

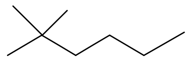
(a) TFTF (b) FTTF (c) TTFT (d) TFFT

17. Which compound is not the isomer of 3-ethyl-2-methylpentane?

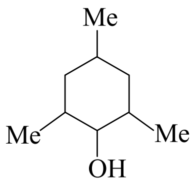
(a) 

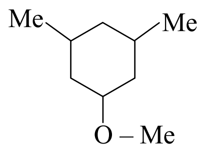
(b) 

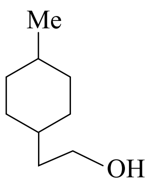
(c) 

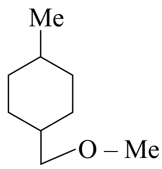
(d) 

18. Which of the following is not the correct relationship?

(i) 

(ii) 

(iii) 

(iv) 

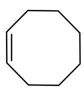
(a) ii and iv are metamers
(b) i and ii are functional isomers
(c) i and iii are chain isomers
(d) i and iv are positional isomers

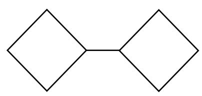
19. What is the correct relationship between the following compounds?

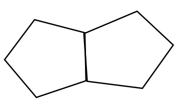
$CH_3-CH_2-CH(CH_3)-CH_2-CH_3$, $CH_3-CH_2-CH_2-CH_2-CH_2(CH_3)$

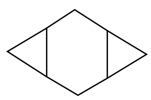
(a) Chain isomers
(b) Position isomers
(c) Functional isomers
(d) Identical

20. Which one of the compound is not isomer of others?

(a) 

(b) 

(c) 

(d) 

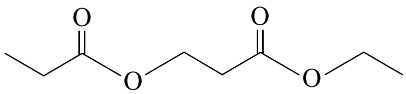
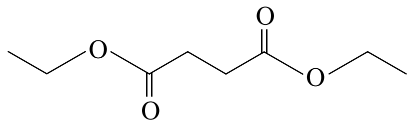
21. $CH_3-CH_2-NH-CHO$; $CH_3-CH(NH_2)-CHO$

i ii

Which type of isomerism is observed between i and ii?

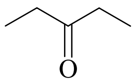
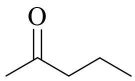
(a) Chain isomers
(b) Position isomers
(c) Functional isomers
(d) Metamers

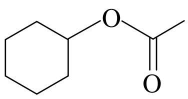
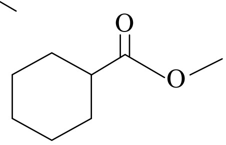
22. The correct relationship among the following pairs of given compounds is

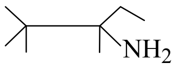
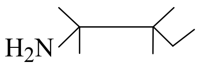
(i)  (ii) 

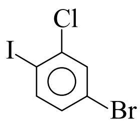
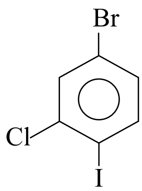
(a) Chain isomer
(b) Positional isomer
(c) Metamer
(d) Functional isomer

23. Which of the following is a pair of metamers?

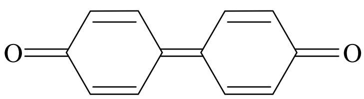
(a)  

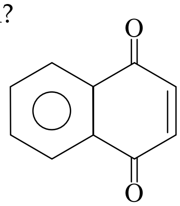
(b)  

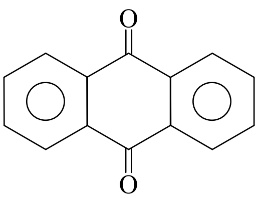
(c)  

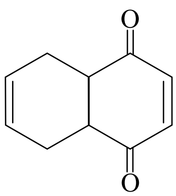
(d)  

24. Which of the following can show tautomerism?

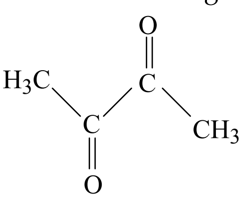
(a) 

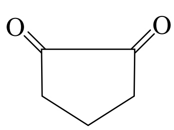
(b) 

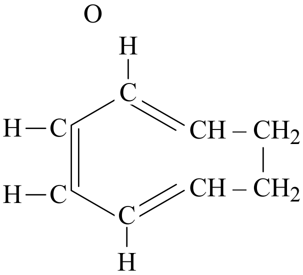
(c) 

(d) 

25. Which of the following can show tautomerism?

(a) 

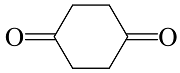
(b) 

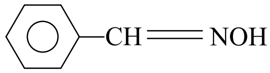
(c) 

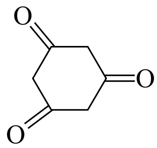
(d) all of these

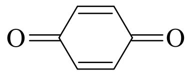
26. Which of the following can show tautomerism?
(a) $(CH_3)_3CNO$ (b) $(CH_3)_2NH$ (c) R_3CNO_2 (d) RCH_2NO_2

27. Which will not show tautomerism?

(a) 

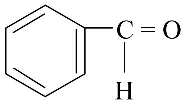
(b) 

(c) 

(d) 

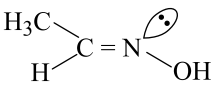
28. Which will not show tautomerism?
(a) $CH_3CH_2CH_2CH_2NO_2$ (b) $(CH_3)_2CH\text{–}CH_2NO_2$
(c) $CH_3CH(NO_2)\text{–}CH_2CH_3$ (d) $(CH_3)_3C\text{–}NO_2$

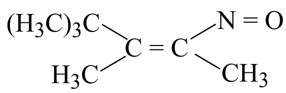
29. Which of the following compound show tautomerism?

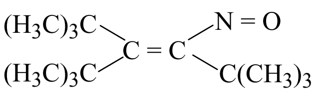
(a) $(H_3C)_2CCl\text{–}CH{=}CH_2$ (b) 

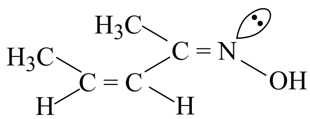
(c) $(H_3C)_2C(NO_2)\text{–}CH{=}CH\text{–}CHO$ (d) None of these

30. Which of the following will not show tautomerism?

(a) 

(b) 

(c) 

(d) 

31. Tautomerism will be exhibited by
(a) $(CH_3)_2NH$ (b) $(CH_3)_3CNO$
(c) R_3CNO_2 (d) RCH_2NO_2

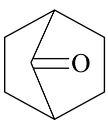
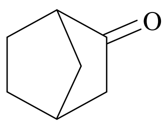
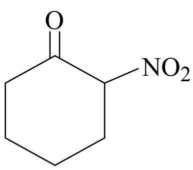
32. Which of the following is not an example of tautomeric equilibrium?

(a) $H_2C=CH-\underset{|}{\overset{}{C}}(H)=O \rightleftharpoons \overset{\oplus}{C}H_2-CH=\underset{|}{C}(H)-\overset{\ominus}{O}$

(b) $-N=N-NH \rightleftharpoons NH-N=N$

(c) $>CH-N=O \rightleftharpoons >C=N-OH$

(d) $-NH-\underset{|}{C}=O \rightleftharpoons -N=\underset{|}{C}-OH$

33. i  ii  iii 

Among these compounds, which of following is the correct order of % enol content?

(a) i > ii > iii (b) iii > ii > i (c) ii > iii > i (d) i > iii > ii

34. Which of the following will have highest percentage of enol content?

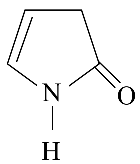
(a) $C_6H_5-\overset{\overset{\displaystyle O}{\|}}{C}-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-OC_2H_5$

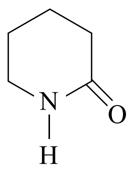
(b) $CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-O-C_2H_5$

(c) $CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-OCH_3$

(d) $CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-CH_3$

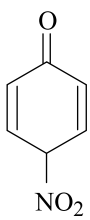
35. Which of the following compounds have less enol content?

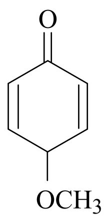
i 

ii 

(a) i (b) ii
(c) Both (a) and (b) (d) None of these

36. Which of the following compounds have higher enol content?

i 

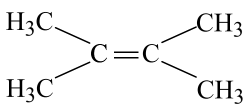
ii 

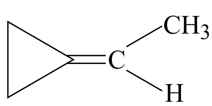
(a) i (b) ii
(c) i = ii (d) None of these

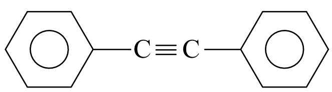
37. Geometrical isomers differ in
(a) position of functional group (b) spatial arrangement of atoms
(c) position of atoms (d) length of carbon chain

38. Stereoisomers have different
(a) Molecular formula (b) Structural formula
(c) Configuration (d) Molecular mass

39. Which of the following compounds has restricted rotation?

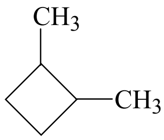
(a) 

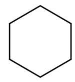
(b) 

(c) 

(d) All of these

40. Which of the following compounds does not have restricted rotation?

(a) 

(b) 

(c) $\begin{matrix}Br\\Cl\end{matrix}\!>\!C{=}C\!<\!\begin{matrix}CH_3\\H\end{matrix}$

(d) $H-\underset{\underset{Br}{|}}{\overset{\overset{CH_3}{|}}{C}}-\underset{\underset{Br}{|}}{\overset{\overset{CH_3}{|}}{C}}-H$

41. Which compound can show geometrical isomerism?

(a) $CH_3CH = C(CH_3)_2$ (b) $CH_3CH = CH_2$
(c) $CH_3CH = CHCH_3$ (d) $(CH_3)_2C = C(CH_3)_2$

42. Which of the following will not show cis-trans isomerism?

(a) $CH_3 - \underset{\underset{CH_3}{|}}{C} = CH - CH_2 - CH_3$ (b) $CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH = CH - CH_2 - CH_3$

(c) $CH_3 - CH = CH - CH_3$ (d) $CH_3 - CH_2 - CH = CH - CH_2 - CH_3$

43. Geometrical isomerism is shown by

(a) $\begin{matrix}H\\H\end{matrix}\!>\!C = C\!<\!\begin{matrix}I\\Br\end{matrix}$ (b) $\begin{matrix}H\\CH_3\end{matrix}\!>\!C = C\!<\!\begin{matrix}I\\Br\end{matrix}$

(c) $\begin{matrix}H_3C\\H_3C\end{matrix}\!>\!C = C\!<\!\begin{matrix}Cl\\Br\end{matrix}$ (d) $\begin{matrix}H\\CH_3\end{matrix}\!>\!C = C\!<\!\begin{matrix}Cl\\Cl\end{matrix}$

44. The "E"-isomer is

(a) $\begin{matrix}F\\Cl\end{matrix}\!>\!C = C\!<\!\begin{matrix}H\\Br\end{matrix}$ (b) $\begin{matrix}H_3C\\H\end{matrix}\!>\!C = C\!<\!\begin{matrix}CH_3\\H\end{matrix}$

(c) $\begin{matrix}H_3C\\H\end{matrix}\!>\!C = C\!<\!\begin{matrix}C_2H_5\\CH(CH_3)_2\end{matrix}$ (d) none of the above

45. The compounds X and Y shown in the below reaction can be

$$Ph - NH{\cdot}NH_2 + (X) + (Y) \xrightarrow{-H_2O} \underbrace{P + Q}_{\text{Organic products}}$$

(a) $CH_3 - CH_2 - \underset{\underset{O}{||}}{C} - CH_3 + CH_3 - \underset{\underset{O}{||}}{C} - Ph$ (b) $Ph - \underset{\underset{O}{||}}{C} - CH_3 + CH_3CHO$

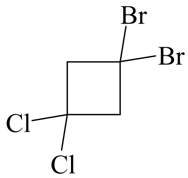
(c) $CH_2 = O + CH_3CHO$(d) $CH_2 = O + CH_3 - \underset{\underset{O}{||}}{C} - CH_3$

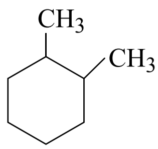
46. The "Z"-isomer is

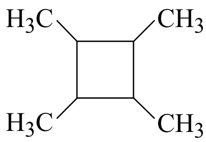
(a) $\begin{matrix}Cl\\F\end{matrix}\!>\!C{=}C\!<\!\begin{matrix}H\\Br\end{matrix}$ (b) $\begin{matrix}Cl\\F\end{matrix}\!>\!C{=}C\!<\!\begin{matrix}CH_3\\C_2H_5\end{matrix}$

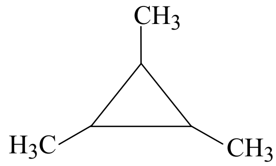
(c) $\begin{matrix}CH_3\\C_2H_5\end{matrix}\!>\!C{=}C\!<\!\begin{matrix}Cl\\COOH\end{matrix}$ (d) $\begin{matrix}HOOC\\H\end{matrix}\!>\!C{=}C\!<\!\begin{matrix}COOH\\H\end{matrix}$

47. Which of the following compounds cannot show geometrical isomerism?

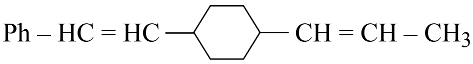
(a) 

(b) 

(c) 

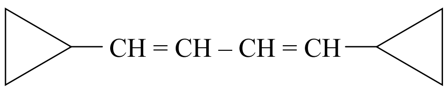
(d) 

48. The total number of geometrical isomers possible in following compound is



(a) 2 (b) 1 (c) 6 (d) 8

49. The total number of geometrical isomers possible in following compound is



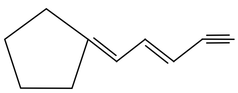
(a) 4 (b) 6 (c) 3 (d) 2

50. The number of geometrical isomers in the following compound is

$$CH_3-CH=CH-CH=CH-C_2H_5$$

(a) 4 (b) 3 (c) 2 (d) 5

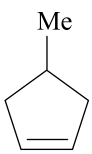
51. The number of cis-trans isomer possible for the following compound is



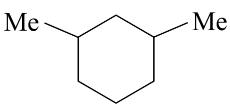
(a) 2 (b) 4 (c) 6 (d) 8

52. What characteristic is the best common to both cis-2-butene and trans-2-butene?
(a) B.P. (b) Dipole moment
(c) Heat of hydrogenation (d) Product of hydrogenation

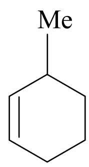
53. Number of chiral carbon atoms in the compound x, y and z respectively would be



X



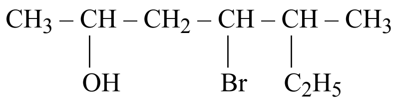
Y



Z

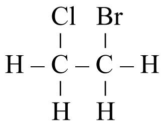
(a) 0, 2, 1 (b) 1, 0, 1 (c) 1, 2, 1 (d) 1, 2, 0

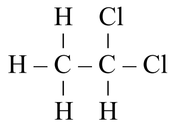
54. Number of chiral carbon persent in the following compound is

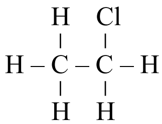


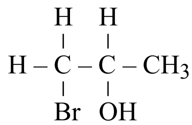
(a) 2 (b) 3 (c) 4 (d) 5

55. Which of the following have asymmetric carbon atom?

(a) 

(b) 

(c) 

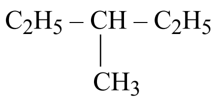
(d) 

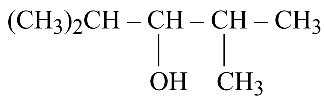
56. Meso-tartaric acid and d-tartaric acid are

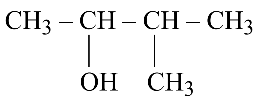
(a) positional isomers (b) enantiomers

(c) diastereomers (d) racemic mixture

57. observe the following structures (i) to (iii)

(i) 

(ii) 

(iii) 

Correct statement is

(a) All three are chiral compounds

(b) i and ii are chiral

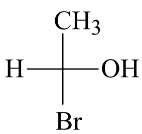
(c) Only ii is chiral

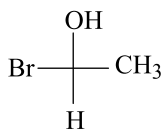
(d) Only iii is chiral

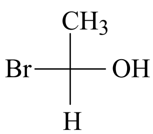
58. The number of optically active compounds in the isomers of C_4H_9Br is

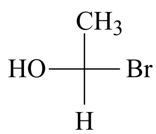
(a) 1 (b) 2 (c) 3 (d) 4

59. Which of the following compound has "S" configuration?

(a) 

(b) 

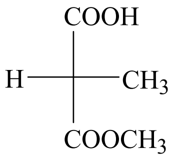
(c) 

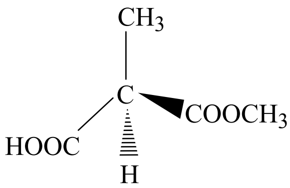
(d) 

60. The number of optically active isomers observed in 2,3-dichlorobutane is

(a) 0 (b) 2 (c) 3 (d) 4

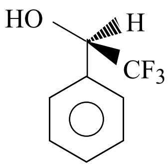
61. The correct configuration assigned for compound (i) and (ii) respectively is

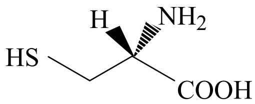
(i) 

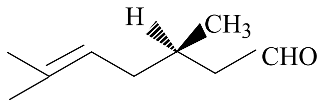
(ii) 

(a) R, R (b) S, S (c) S, R (d) R, S

62. The R/S configurations of these compounds are respectively

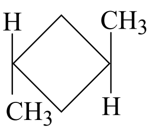


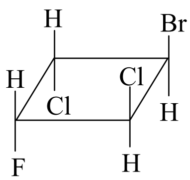


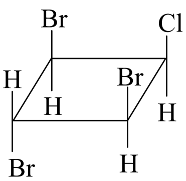


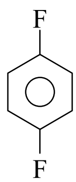
(a) R, R, R (b) R, S, R (c) R, S, S (d) S, S, S

63. Which of the following compound has plane of symmetry (POS) but not centre of symmetry (COS)?

(a) 

(b) 

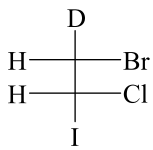
(c) 

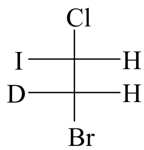
(d) 

64. The instrument which can be used to measure optical activity, i.e., specific rotation

(a) Refractometer (b) Photometer
(c) Voltmeter (d) Polarimeter

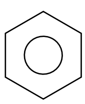
65. The two compounds given below are

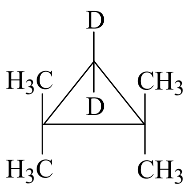


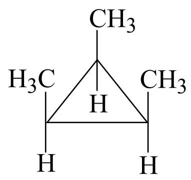


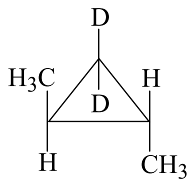
(a) Enantiomer (b) Identical
(c) Meso compound (d) Diastereomers

66. Which of the following compounds do not possess a C_2 axis of symmetry?

(a) 

(b) 

(c) 

(d) 

67. How many stereoisomers can exist for the following acid?

$$\begin{array}{l} H-C(OH).CO_2H \\ \quad\ \ | \\ H-C.CO_2H \\ \quad\ \ | \\ H-C(OH).CO_2H \end{array}$$

(a) Two (b) Four (c) Eight (d) Sixteen

68. $$\begin{array}{ccccccccc} CH_3 & - & CH & - & CH & - & CH & - & CH_3 \\ & & | & & | & & | & & \\ & & Br & & Br & & Br & & \end{array}$$

Total number of stereoisomers in the above compound is

(a) 6 (b) 4 (c) 8 (d) 16

69. Total number of stereoisomers of the compound is given below

$$\begin{array}{ccccccc} CH_3 & - & CH & - & CH & - & CH_3 \\ & & | & & | & & \\ & & OH & & Br & & \end{array}$$

(a) 2 (b) 4 (c) 6 (d) 8

70. How many stereoisomers of the following molecule are possible?

$$HOOC.CH = C = CH.COOH$$

(a) two optical isomers
(b) two geometrical isomers
(c) two optical and two geometrical isomers
(d) none

71. Total number of stereoisomer of compound is given below

$$\begin{array}{ccccccccccccc} CH_3 & - & CH & = & CH & - & CH & - & CH & = & CH & - & C_2H_5 \\ & & & & & & | & & & & & & \\ & & & & & & Cl & & & & & & \end{array}$$

(a) 2 (b) 4 (c) 6 (d) 8

72. $$\begin{array}{ccccccccc} CH_3 & - & CH & - & CH & - & CH & - & CH_3 \\ & & | & & | & & | & & \\ & & Cl & & Br & & OH & & \end{array}$$

Total number of stereoisomers in the above compound is

(a) 6 (b) 4 (c) 8 (d) 16

73. The enantiomeric excess and observed specific rotation of a mixture containing 6 g of (+)-2-butanol and 4 (g) of (–)-2-butanol are respectively (If the specific rotation of enantiomerically pure (+)-2-butanol is +13.5 units)

(a) 80%, +2.7 unit (b) 20%, –27 unit
(c) 20%, +2.7 unit (d) 80%, –27 unit

74. Which of the following pair of isomers cannot be separated by fractional crystallisation or fractional distillation?

(a) Maleic acid and fumaric acid

(b) (+)-Tartaric acid and meso-tartaric acid

(c) $CH_3-\underset{\displaystyle NH_2}{\underset{|}{CH}}-COOH$ and $H_2N-CH_2-CH_2-COOH$

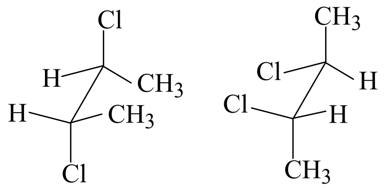
(d) (+)-lactic acid and (–)-lactic acid

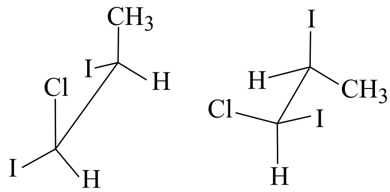
75. Increasing order of stability among the three main conformation (i.e., eclipse, anti, gauche) of ethylene glycol is

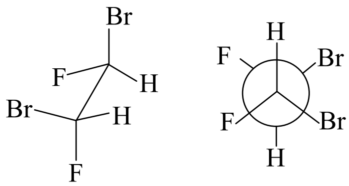
(a) Eclipse, gauche, anti (b) Gauche, eclipse, anti

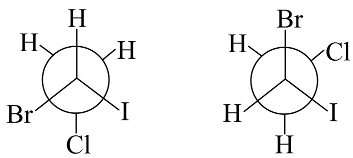
(c) Eclipse, anti, gauche (d) Anti, gauche, eclipse

76. Which of the following pairs of compound is/are identical?

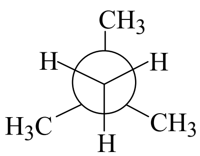
(a)


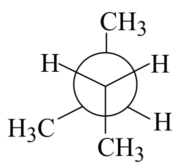
(b)


(c)


(d)


77. The two structures (i) and (ii) represent

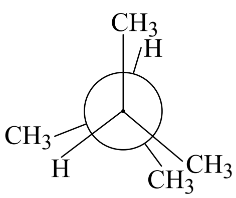
(i)


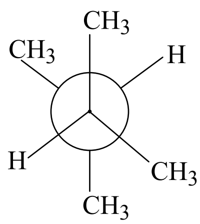
(ii)


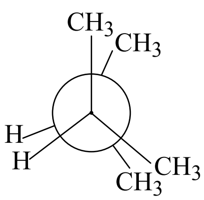
(a) Conformational isomers (b) Stereoisomers

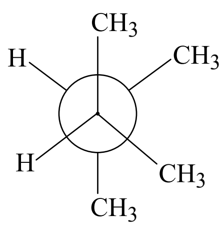
(c) Constitutional isomers (d) Identical

78. In which of the following has minimum torsional strain and minimum Vander waal strain?

(i)


(ii)


(iii)


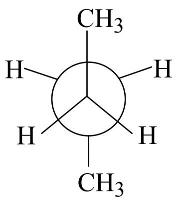
(iv)


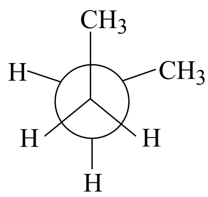
(a) i (b) ii (c) iii (d) iv

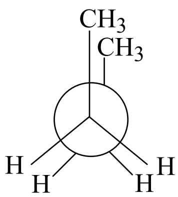
79. In the Newman projection formula of the least stable staggered form of n-butane, which of the following reasons is the causes of its unstability?

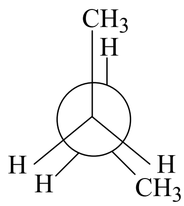
(a) Van der Waal's strain (b) Torsional strain
(c) Combination of both (d) None of these

80. Which of the following represent the staggered conformation with dihedral angle $\phi = 60$?

(a) 

(b) 

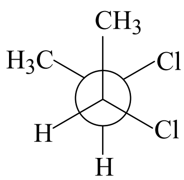
(c) 

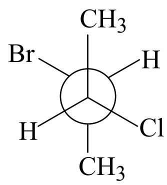
(d) 

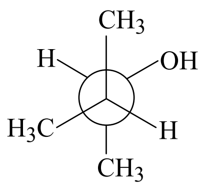
81. The dihedral angle between two methyl groups in partially eclipsed conformation of n-butane is

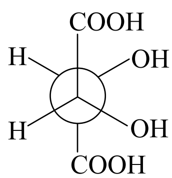
(a) 180° (b) 120° (c) 90° (d) 109°28′

82. Which of the following is an achiral molecule?

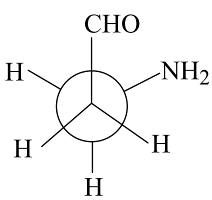
(a) 

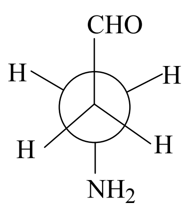
(b) 

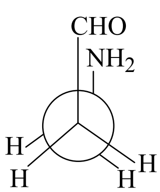
(c) 

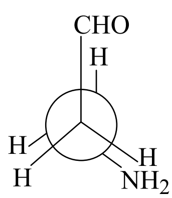
(d) 

83. Which of the following is most stable?

(a) 

(b) 

(c) 

(d) 

84. Evaporation of an aqueous solution of ammonium cyanate gives urea. This reaction follows the class of

(a) Polymerisation (b) Isomerisation
(c) Association (d) Dissociation

85. The possible number of alkynes with the formula C_5H_8 is

(a) 2 (b) 3 (c) 4 (d) 5

86. How many isomers of $C_5H_{11}OH$ will be primary alcohols

(a) 2 (b) 3 (c) 4 (d) 5

87. Number of isomeric forms of C_7H_9N having benzene ring will be

(a) 7 (b) 6 (c) 5 (d) 4

88. Which of the following is an isomer of diethyl ether

(a) $(CH_3)_3COH$ (b) CH_3CHO
(c) C_3H_7OH (d) $(C_2H_5)_2CHOH$

89. Total number of isomeric alcohols with the formula $C_4H_{10}O$ is

(a) 1 (b) 2 (c) 3 (d) 4

90. The molecular formula of a saturated compound is $C_2H_4Cl_2$. The formula permits the existence of two

(a) functional isomers (b) position isomers
(c) optical isomers (d) cis-trans isomers

91. The type of isomerism found in urea molecule is

(a) Chain (b) Position
(c) Tautomerism (d) None of these

92. An alkane can show structural isomerism if it has .... number of minimum carbon atoms

(a) 1 (b) 2 (c) 3 (d) 4

93. How many chain isomers can be obtained from the alkane C_6H_{14}?

(a) 4 (b) 5 (c) 6 (d) 7

94. Keto-enol tautomerism is observed in

(a) $C_6H_5-\overset{\overset{O}{||}}{C}-H$ (b) $C_6H_5-\overset{\overset{O}{||}}{C}-CH_3$

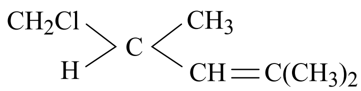
(c) $C_6H_5-\overset{\overset{O}{||}}{C}-C_6H_5$ (d) $C_6H_5-\overset{\overset{O}{||}}{C}-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-C_6H_5$

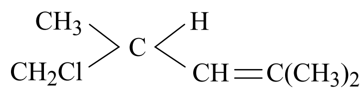
95. The number of geometrical isomers in case of a compound with the structure

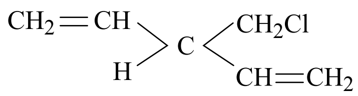
$$CH_3–CH=CH–CH=CH–C_2H_5 \text{ is}$$

(a) 4 (b) 3 (c) 2 (d) 5

96. Which one of the following will show geometrical isomerism?

(a) 

(b) 

(c) 

(d) $CH_3CH_2CH{=}CHCH_2CH_3$

97. In the reaction: $CH_3CHO + HCN \longrightarrow CH_3CH(OH)CN$

a chiral centre is produced. The number of stereoisomers of the product is

(a) 3 (b) 2
(c) 4 (d) none of these

98. The molecule 3-penten-2-ol can exhibit

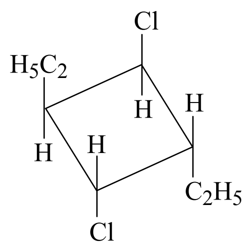
(a) Optical isomerism (b) Geometrical isomerism
(c) Metamerism (d) Tautomerism

The correct answer is

(a) (a) and (b) (b) (a) and (c) (c) (b) and (c) (d) (a) and (d)

99. Find the total number of isomers (including stereo isomers) in dimethyl cyclopropane and dimethyl cyclobutane

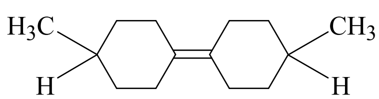
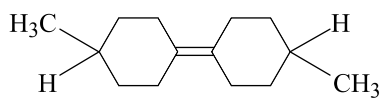
(a) 6, 8 (b) 5, 6 (c) 4, 5 (d) 4, 6

100.  has

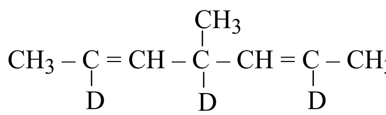
(a) plane of symmetry (b) centre of symmetry
(c) C_3 axis of symmetry (d) C_4 axis of symmetry

101. How many optically active cycloalkanones are possible with the molecular formula C_5H_8O?

(a) 8 (b) 6 (c) 5 (d) 4

102.  and  is/are

(a) Geometrical isomers (b) Position isomers
(c) Chain isomers (d) Enantiomers

103. For the given compound which of the  following statement(s) are correct?

(a) It has 4 stereoisomers
(b) It has 3 stereoisomers
(c) It has 2 chiral centres
(d) The compound does not show G.I.

104. Racemic mixture is formed by mixing two
(a) Isomeric compounds (b) Chiral compounds
(c) Meso compounds (d) Enantiomers

105. Which of the following does not show geometrical isomerism?
(a) 1,2-dichloro-1-pentene (b) 1,3-dichloro-2-pentene
(c) 1,1-dichloro-1-pentene (d) 1,4-dichloro-2-pentene

106. The general formula $C_nH_{2n}O_2$ could be for open chain
(a) Diketones (b) Carboxylic acids
(c) Diols (d) Dialdehydes

107. Among the following four structures i to iv

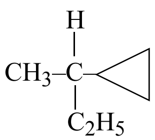
(i) $C_2H_5-CH(CH_3)-C_3H_7$ (ii) $CH_3-C(=O)-CH(CH_3)-C_2H_5$

(iii) $H-\overset{\oplus}{C}H_2$ (iv) $C_2H_5-CH(CH_3)-C_2H_5$

it is true that
(a) All four are chiral compounds
(b) Only i and ii are chiral compounds
(c) Only iii is a chiral compound
(d) Only ii and iv are chiral compounds

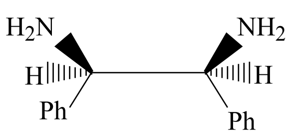
108. Amongst the following compounds, the optically active alkane having lowest molecular mass is

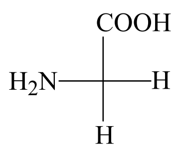
(a) $CH_3–CH_2–CH_2–CH_3$ (b) $CH_3-CH_2-CH(CH_3)-CH_3$

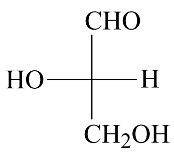
(c)  (d) $CH_3–CH_2–C≡CH$

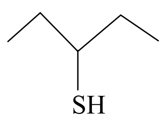
109. Which of the following compounds is not chiral?
(a) 1-chloropentane (b) 2-chloropentane
(c) 1-chloro-2-methylpentane (d) 3-chloro-2-methylpentane

110. Which of the following molecules is expected to rotate the plane of polarised light?

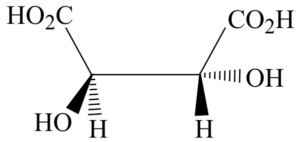
(a) 

(b) 

(c) 

(d) 

111. The correct decreasing order of priority for the functional groups of organic compounds in the IUPAC system of nomenclature is
(a) $–SO_3H$, –COOH, $–CONH_2$, –CHO
(b) –CHO, –COOH, $–SO_3H$, $–CONH_2$
(c) $–CONH_2$, –CHO, $–SO_3H$, –COOH
(d) –COOH, $–SO_3H$, $–CONH_2$, –CHO

112. The absolute configuration of  is

(a) R, R (b) R, S (c) S, R (d) S, S

113. The alkene that exhibits geometrical isomerism is
(a) 2-methyl propene (b) 2-butene
(c) 2-methyl-2-butene (d) propene

114. The number of stereoisomers possible for a compound of the molecular formula CH_3–CH=CH–CH(OH)–Me is
(a) 2 (b) 4 (c) 6 (d) 3

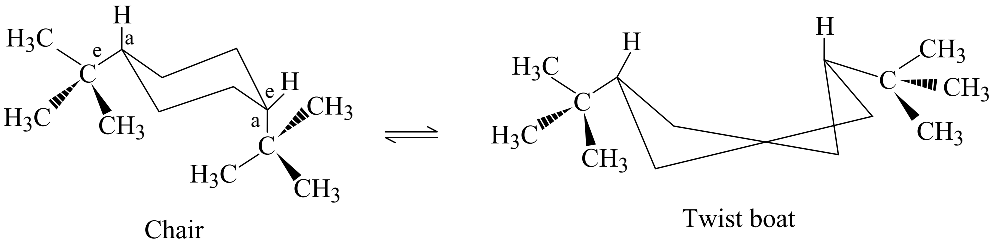
115. Out of the following, the alkene that exhibits optical isomerism is
(a) 3-methyl-2pentene (b) 4-methyl-1-pentene
(c) 3-methyl-1-pentene (d) 2-methyl-2-pentene

116. Identify the compound that exhibits tautomerism
(a) 2-butene (b) Lactic acid (c) 2-pentanone (d) Phenol

LEVEL 2

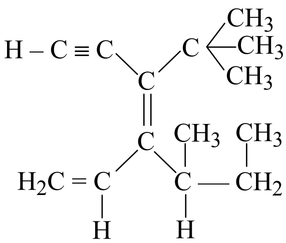
Single and Multiple-choice Type

1. The value of equilibrium constant (K) for the following equilibria



(a) K = 1
(b) K > 1
(c) K < 1
(d) Cannot relate

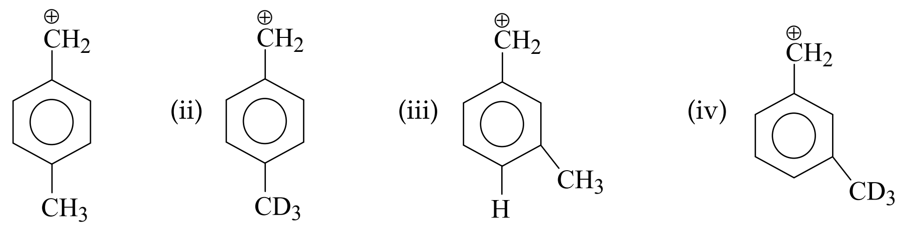
2. E/Z nomenclature of the following compound is



(a) E
(b) Z
(c) Does not show geometrical isomerism
(d) None

3. Correct order of stability of the following carbocations is

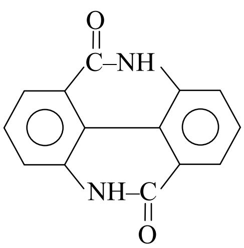
(i) (ii) (iii) (iv)



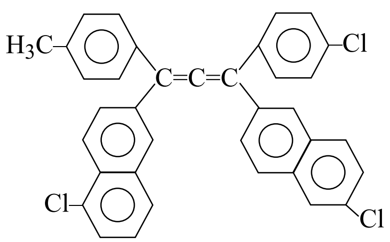
(a) i > ii > iii > iv
(b) i > ii > iv > iii
(c) ii > i > iv > iii
(d) i > iv > ii > ii

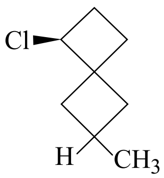
4. Which of the following compounds are chiral?

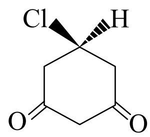
(i)

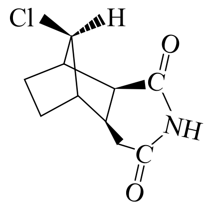


(ii)



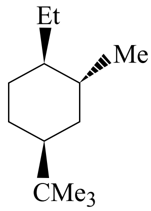
(iii) 

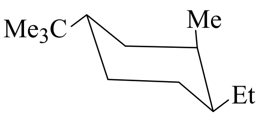
(iv) 

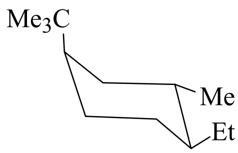
(v) 

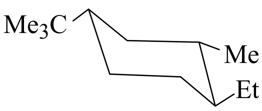
(a) i, ii, iii, v (b) ii, iii, v (c) i, ii, iii, v (d) i, iv, v

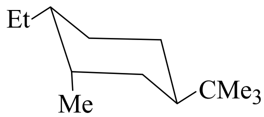
5. The conformation of the following compound is



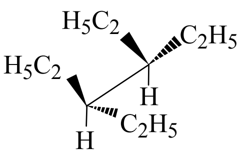
(a) 

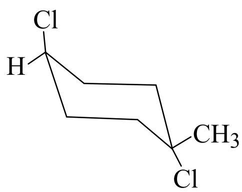
(b) 

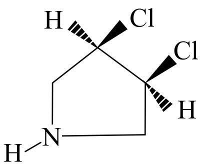
(c) 

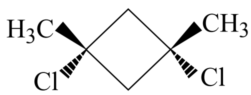
(d) 

6. Which of the following represent the meso compound?

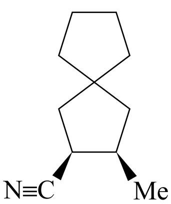
(a) 

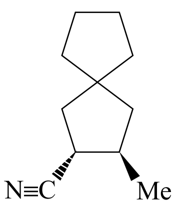
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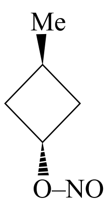
(c) 

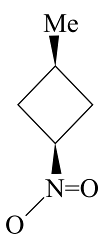
(d) 

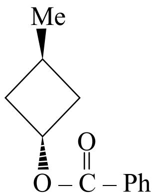
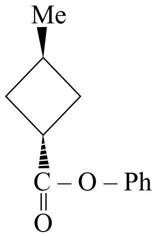
7. Among the following pair of compounds functional isomer is

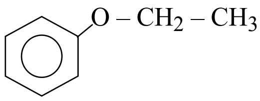
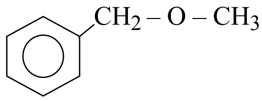
(a) 

and 

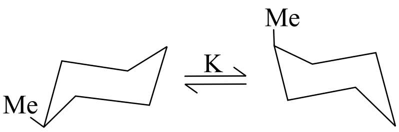
(b) 

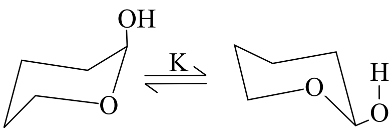
and 

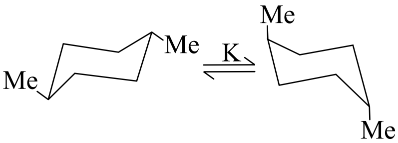
(c)  and 

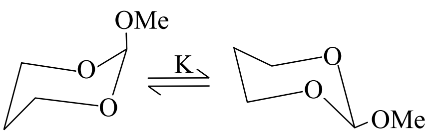
(d)  and 

8. Identify equilibrium which has maximum K (equilibrium constant)

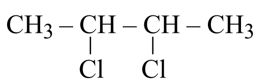
(a) 

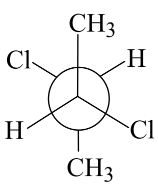
(b) 

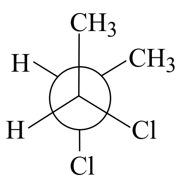
(c) 

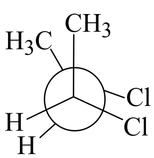
(d) 

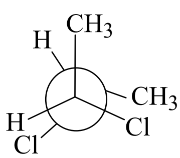
9. The most stable Newmann projection of the 2,3-dichlorobutane, whose Fischer projection is given below is



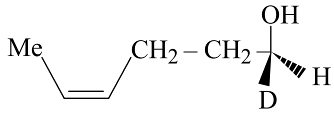
(a) 

(b) 

(c) 

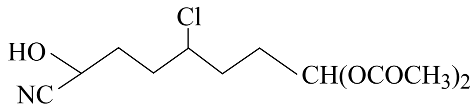
(d) 

10. The correct stereochemical descriptions for the structure given below are



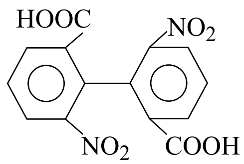
(a) 1S, 4E (b) 1R, 4E (c) 1R, 4Z (d) 1S, 4Z

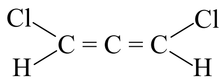
11. The number of optical isomers possible for the compound is

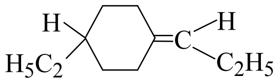


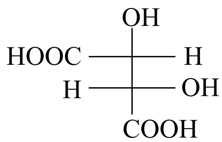
(a) 2 (b) 4 (c) 8 (d) 6

12. Which one of the following compounds will not rotate the plane of plane polarised light?

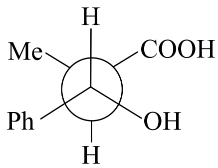
(a) 

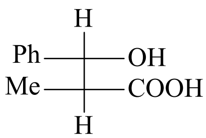
(b) 

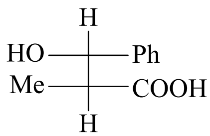
(c) 

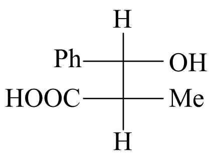
(d) 

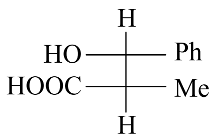
13. The correct Fischer projection formula of the Newman projection representation is



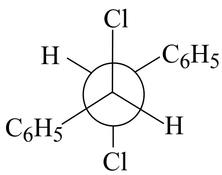
(a) 

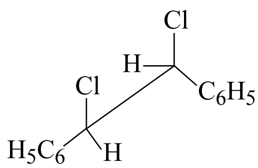
(b) 

(c) 

(d) 

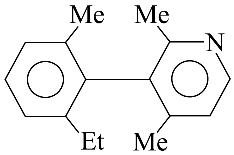
14. Which one of the following statements regarding the projections shown below (i and ii) is correct?

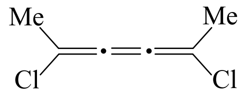
(i) 

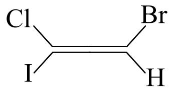
(ii) 

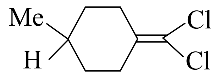
(a) Both the projections represent the same configuration
(b) Both (i) and (ii) are optically active
(c) Only (i) is optically active
(d) Only (ii) is optically active

15. Among the following compounds which is used for resolution of racemic mixture?

(a) 

(b) 

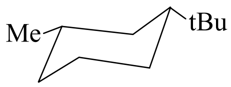
(c) 

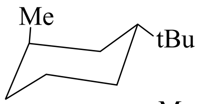
(d) 

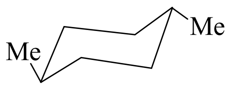
16. Identify specific rotation of a mixture have 5 g of (+)2-butanol and 7 g of (–)2-butanol (If specific rotation of 100% pure compound is 13.5°)

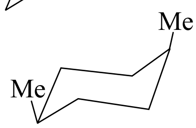
(a) –2.25° (b) –1.6° (c) 12.2° (d) 4.45°

17. Identify compound having highest heat of combustion

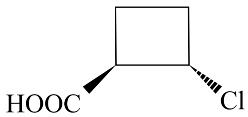
(a) 

(b) 

(c) 

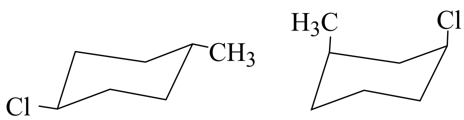
(d) 

18. Identify R and S configurations of chiral centres in the following compound



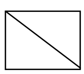
(a) (i)-R (ii)-S (b) (i)-S (ii)-R (c) (i)-S (ii)-S (d) (i)-R (ii)-S

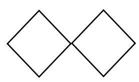
19. What is the relationship between the two structures shown?

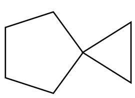


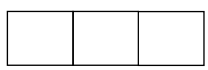
(a) Different drawings of the same conformation of the same compound
(b) Stereoisomers
(c) Constitutional isomers
(d) Different conformations of the same compound

20. C_8H_{12} has 3° of unsaturation. Thus, it can have the structure

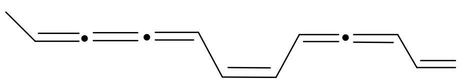
(a) 

(b) 

(c) 

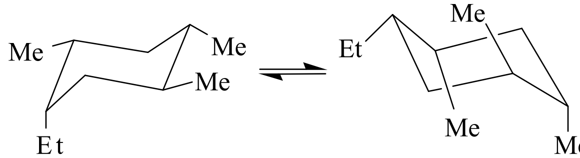
(d) 

21. Calculate the total number of geometrical isomers for the following compound



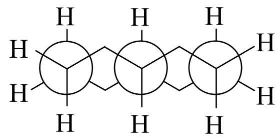
(a) 2 (b) 4 (c) 8 (d) 16

22. Identify the value of K_C for the following equilibrium

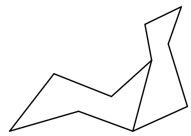


(a) $K_C > 1$ (b) $K_C < 1$ (c) $K_C = 1$ (d) None of these

23. Identify the relationship between the following pairs of compound

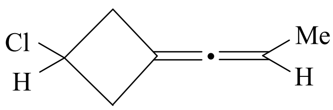


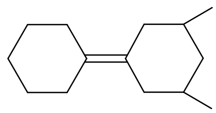
and

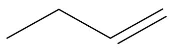


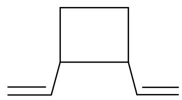
(a) Positional isomers (b) Geometrical isomers
(c) Functional isomers (d) Identical compounds

24. Identify compounds that give geometrical isomerisation

(a) 

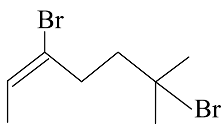
(b) 

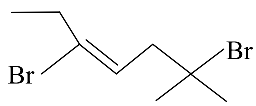
(c) 

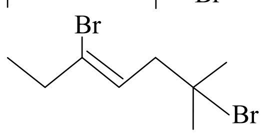
(d) 

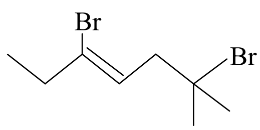
25. Which conformation has a C_3 axis of symmetry?
(a) Boat (b) Twist boat (c) Chair (d) Enveloped

26. Which of following represent (E)-3, 6-dibromo-6-methyl-3-heptene?

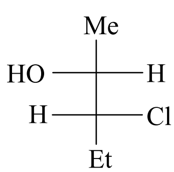
(a) 

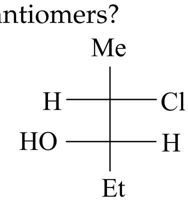
(b) 

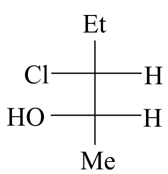
(c) 

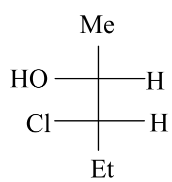
(d) 

27. Which of the following represent a pair of enantiomers?

(i) 

(ii) 

(iii) 

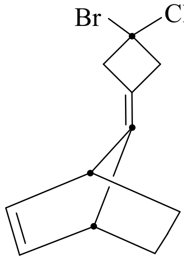
(iv) 

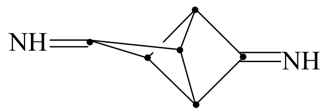
(a) i and ii (b) iii and iv (c) i and iv (d) ii and iii

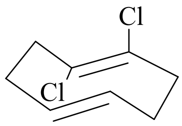
28. Choose the total number of constitutional isomers with the formula $C_4H_{10}O$.

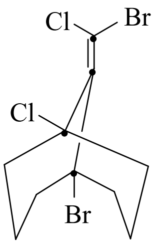
(a) 9 (b) 7 (c) 5 (d) 3

29. Identify optically active molecules

(a) 

(b) 

(c) 

(d) 

30. In which structure Gauche form has less potential energy than antiform

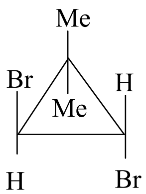
(a) $CH_3-CH_2-CH_2-Cl$

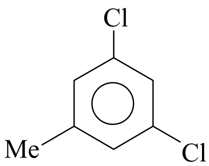
(b) $HO-CH_2-CH_2-F$

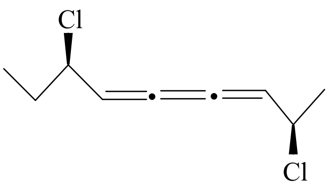
(c) $\underset{Br}{CH_2}-\underset{Br}{CH_2}$

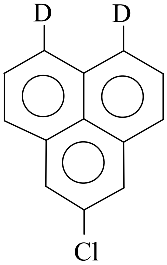
(d) $HO-CH_2-CH_2-OH$

31. Which of the following molecule/s show the plane of symmetry as well as axis of symmetry?

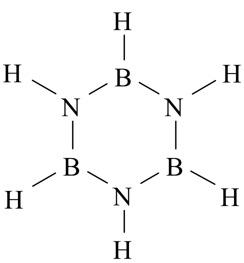
(a) 

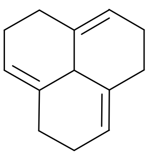
(b) 

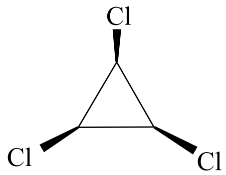
(c) 

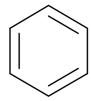
(d) 

32. The C_3 axis of symmetry is present in which of the following compounds?

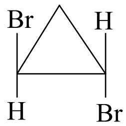
(a) 

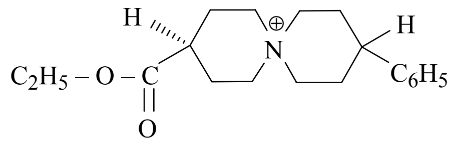
(b) 

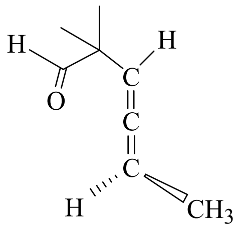
(c) 

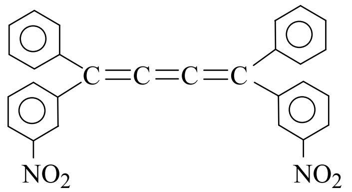
(d) 

33. Which of the following compounds are chiral?

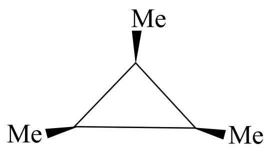
(a) 

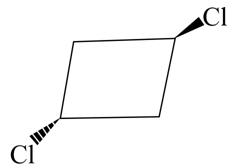
(b) 

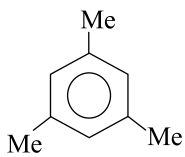
(c) 

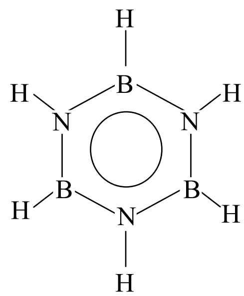
(d) 

34. Which of the following molecule(s) has C_3 axis of symmetry and plane of symmetry?

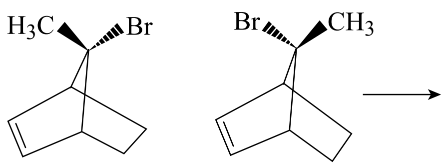
(a) 

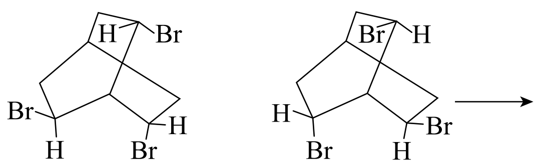
(b) 

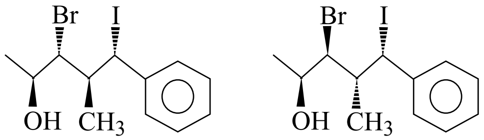
(c) 

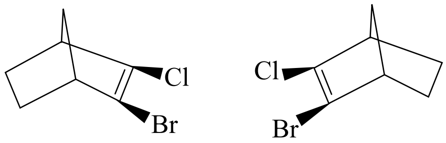
(d) 

35. In which of the following case correct relationship is given?

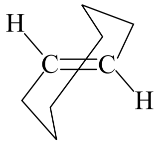
(a)  → Enantiomers

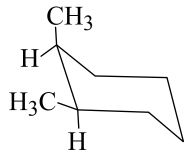
(b)  → Enantiomers

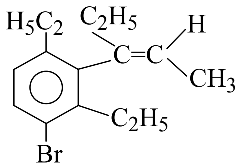
(c)  ⟶ Diastereomers

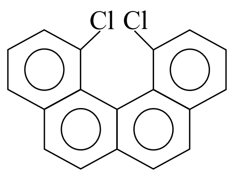
(d)  ⟶ Enantiomers

36. Which of the following is an optically active compound?

(a) 

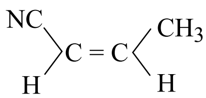
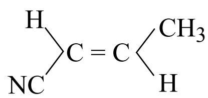
(b) 

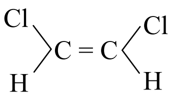
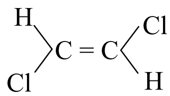
(c) 

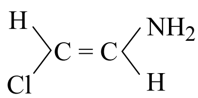
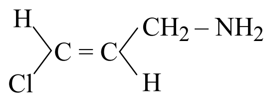
(d) 

37. Which of the following options is correct?

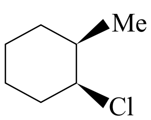
(a) pk_1 Cis but-2-ene dioic acid $<$ Trans but-2-ene dioic acid

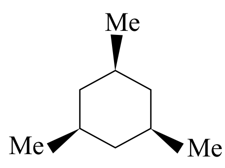
(b) Dipole moment  $<$ 

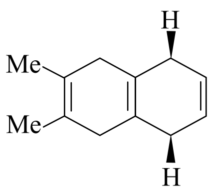
(c) Stability  $<$ 

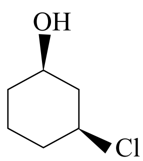
(d) Basicity  $<$ 

38. Which of the following are optically active?

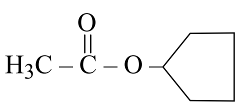
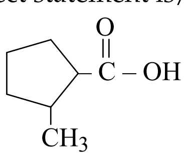
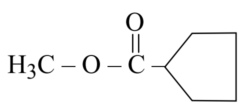
(a) 

(b) 

(c) 

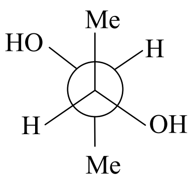
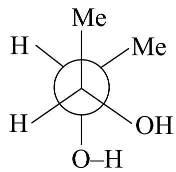
(d) 

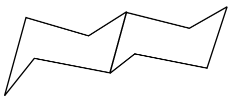
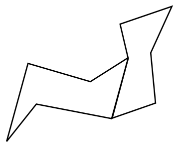
39. For the given compounds, correct statement is/are

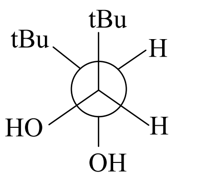
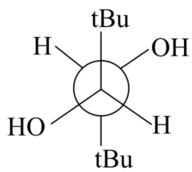
(i)  (ii)  (iii) 

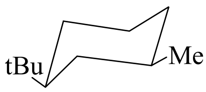
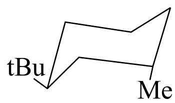
(a) i and ii are positional isomers
(b) ii and iii are functional group isomers
(c) i and iii are metamers
(d) i and iii are positional isomers

40. Among the following pair of compounds or conformers, identify pair(s) in which the I[st] compound has more stability than the II[nd]

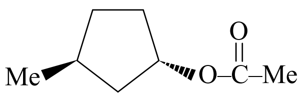
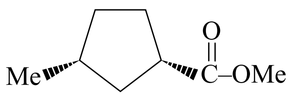
(a)  and 

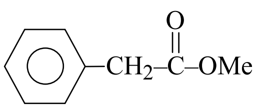
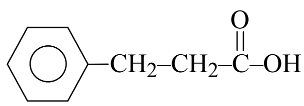
(b)  and 

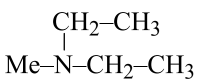
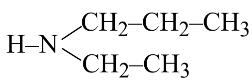
(c)  and 

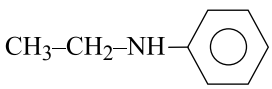
(d)  and 

41. Among the following pair of compounds identify metamers

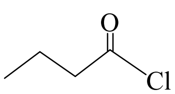
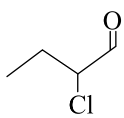
(a)  and 

(b)  and 

(c)  and 

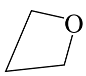
(d)  and CH_3–NH–CH_2–Ph

42. Which of the following pairs show functional group isomerism?

(a)  and 

(b) $CH_3COOCOC_6H_5$ and $C_6H_5COOCOCH_3$

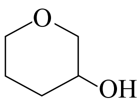
(c) $HCOOCH_3$ and CH_3COOH

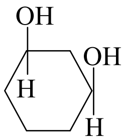
(d) CH_3COCH_3 and 

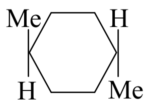
43. Identify compound(s) in which gauche conformer is more stable than staggered

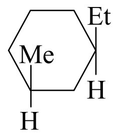
(a) Ethylene diamine (b) Succinic acid
(c) Ethylene glycol (d) n-butane

44. Identify the compound which has axial conformer more stable than equatorial

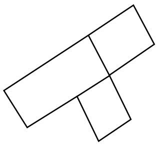
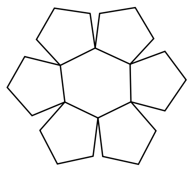
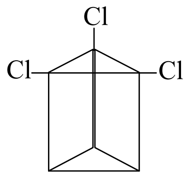
(a) 

(b) 

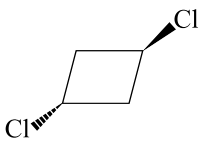
(c) 

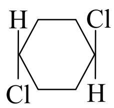
(d) 

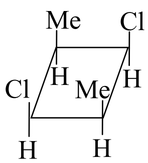
45. Among the following compounds, C_3 axis is present in

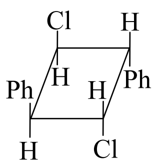
(a) 
(b) PCl_5
(c) 
(d) 

46. Identify among the following compounds having plane of symmetry, centre of symmetry and axis of symmetry

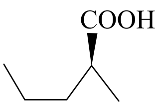
(a) 

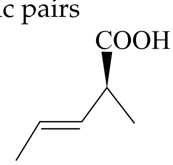
(b) 

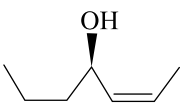
(c) 

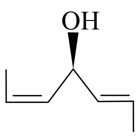
(d) 

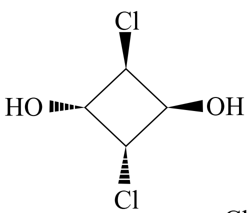
47. Identify diastereo isomeric pairs

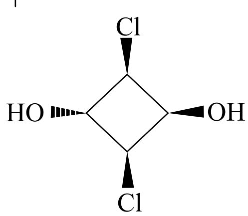
(a) 

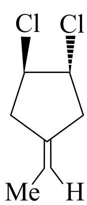
and 

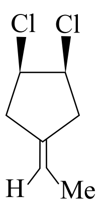
(b) 

and 

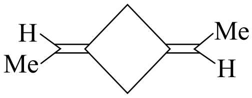
(c) 

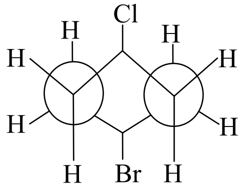
and 

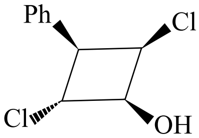
(d) 

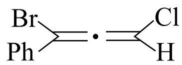
and 

48. Identify the optically active compound

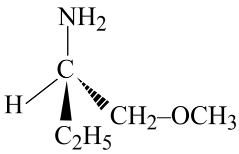
(a) 

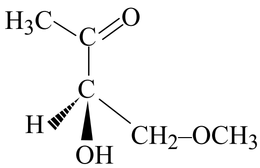
(b) 

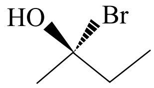
(c) 

(d) 

49. Which of the following statements is correct?

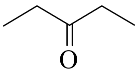
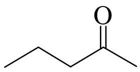
(i) 

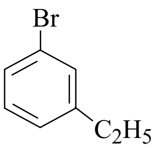
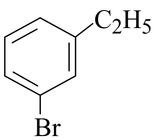
(ii) 

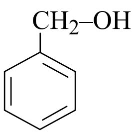
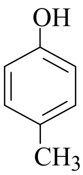
(iii) 

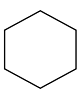
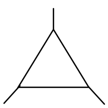
(a) i and ii have R-configuration
(b) i and iii have R-configuration
(c) Only iii has R-configuration
(d) i and iii have S-configuration

50. Which of the following relationships are correctly matched?

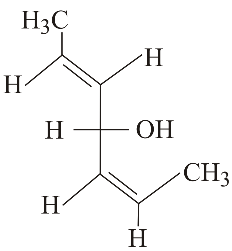
(a)  and  ⟶ Positional isomers

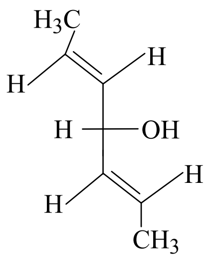
(b)  and  ⟶ Identical

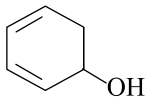
(c)  and  ⟶ Positional isomers

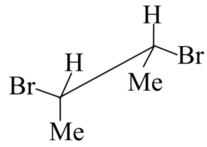
(d)  and  ⟶ Chain isomers

51. Which of the following molecules is/are optically active?

(a) 

(b) 

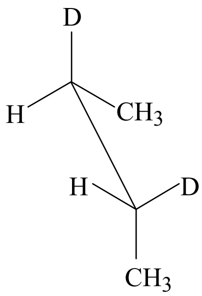
(c) 

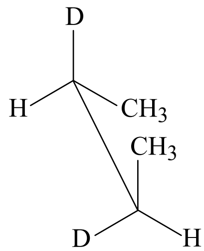
(d) 

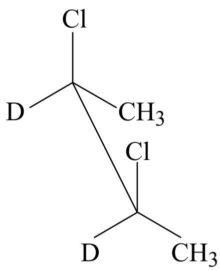
52. Identify compound(s) in which gauche conformer is more stable than staggered

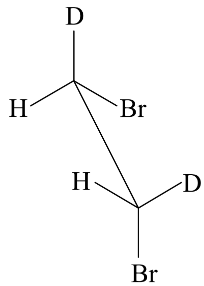
(a) 1, 2-difluoroethane
(b) Chloropropane
(c) Ethylene glycol
(d) Succinic acid

53. Identify the structure of Erythro

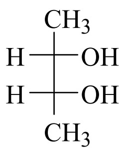
(a) 

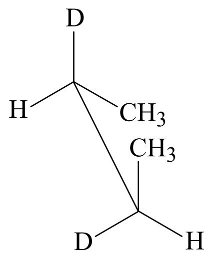
(b) 

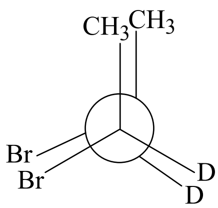
(c) 

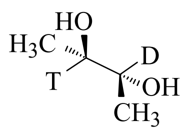
(d) 

54. Identify the structure of Erythro

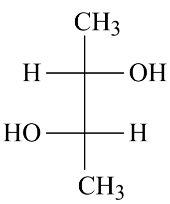
(a) 

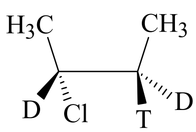
(b) 

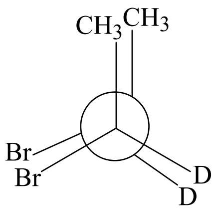
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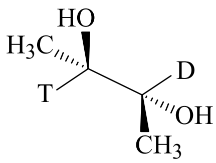
(d) 

55. Identify the structure of Threo

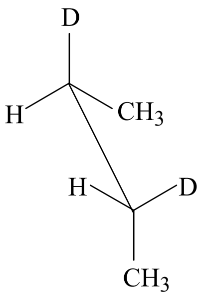
(a) 

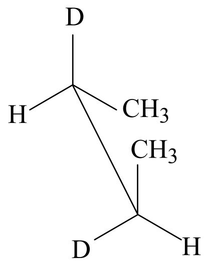
(b) 

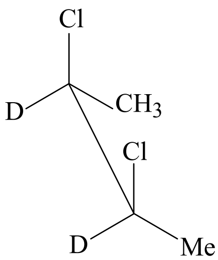
(c) 

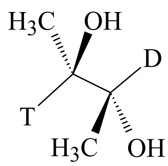
(d) 

56. Identify the structure of meso compounds

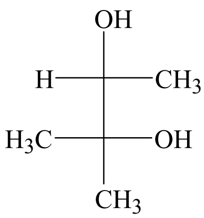
(a) 

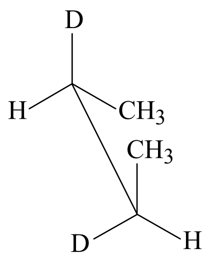
(b) 

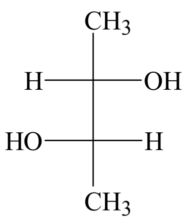
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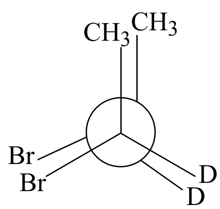
(d) 

57. Identify the structure of meso compounds

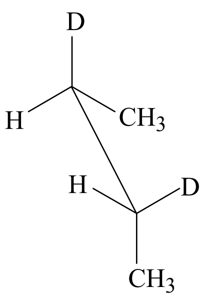
(a) 

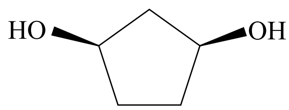
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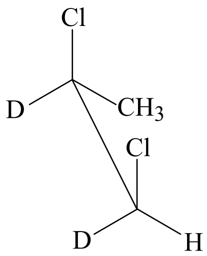
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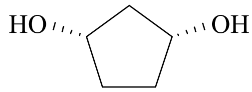
(d) 

58. Identify the structure of optically inactive compounds

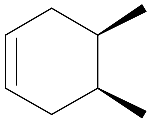
(a) 

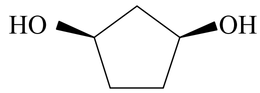
(b) 

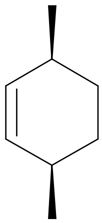
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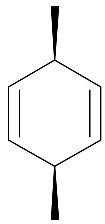
(d) 

59. Identify the structure of Meso

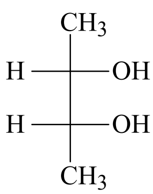
(a) 

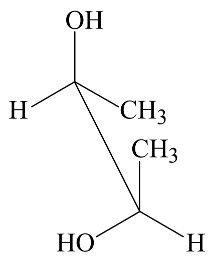
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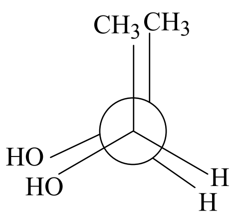
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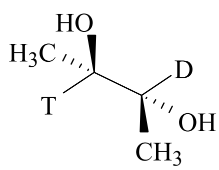
(d) 

60. Identify the structure of identical compounds

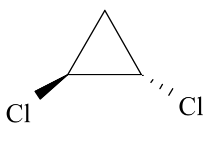
(a) 

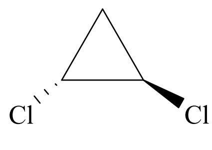
(b) 

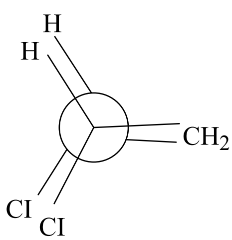
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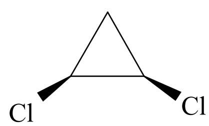
(d) 

61. Identify the structure of identical compounds

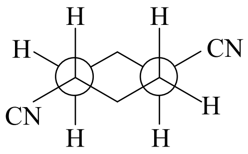
(a) 

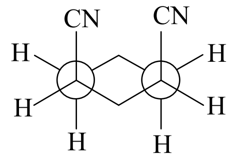
(b) 

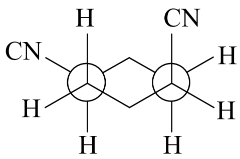
(c) 

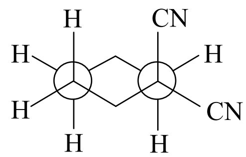
(d) 

62. Identify the geometrical isomers

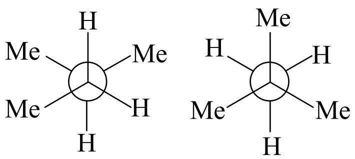
(a) 

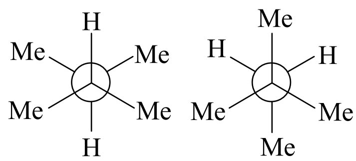
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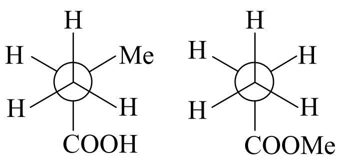
(c) 

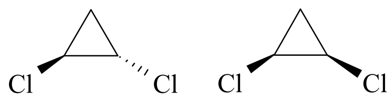
(d) 

63. Identify the pair of chain isomers

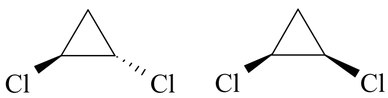
(a) 

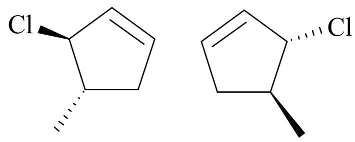
(b) 

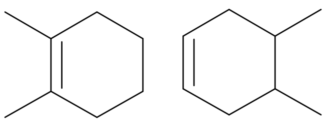
(c) 

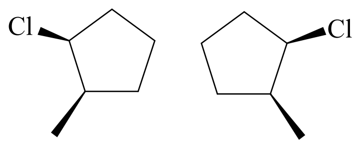
(d) 

64. Identify the pair of diastereoisomers

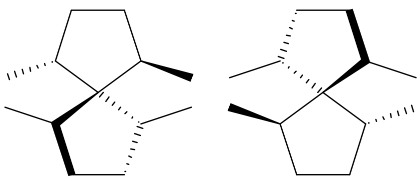
(a) 

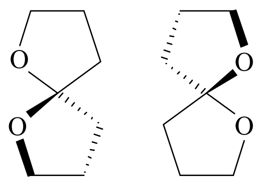
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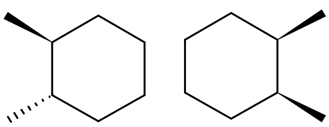
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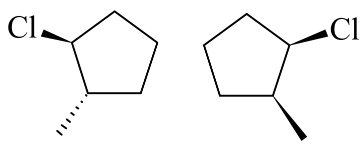
(d) 

65. Identify the pair of diastereoisomers

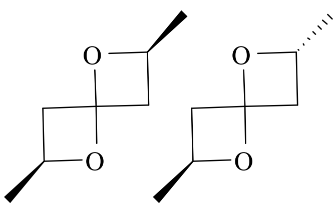
(a) 

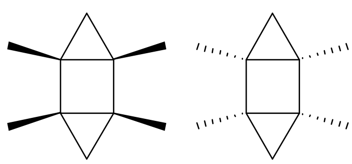
(b) 

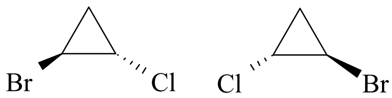
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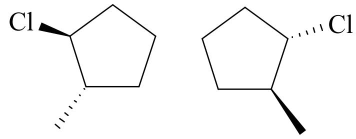
(d) 

66. Identify the pair of diastereomers

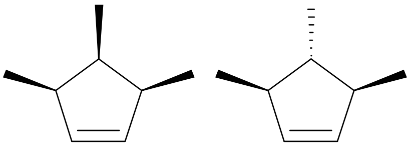
(a) 

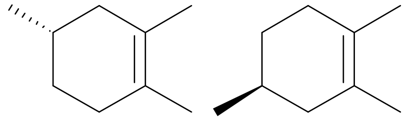
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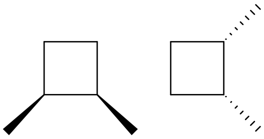
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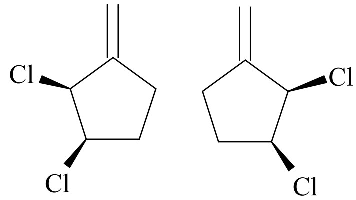
(d) 

67. Identify the pair of diastereoisomers

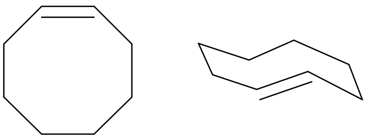
(a) 

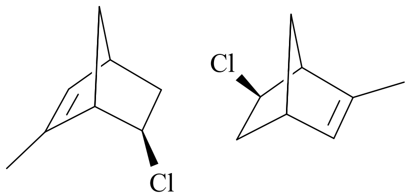
(b) 

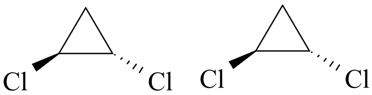
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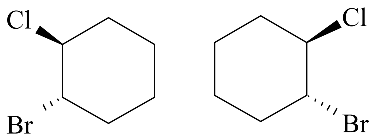
(d) 

68. Identify the pair of enantiomers

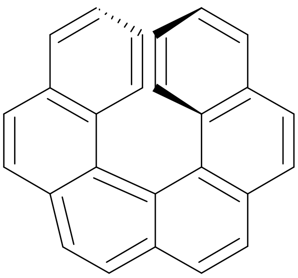
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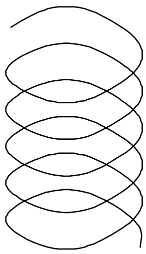
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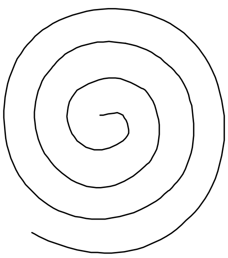
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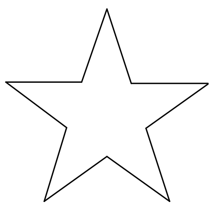
(d) 

69. Identify the optically active shape

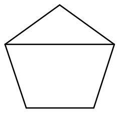
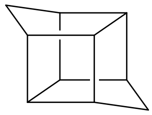
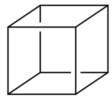
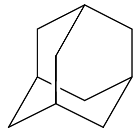
(a) 

(b) 

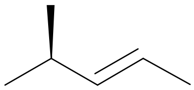
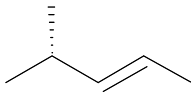
(c)  (planner)

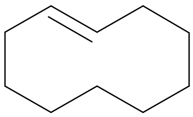
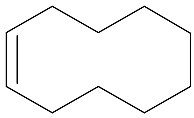
(d)  (planner)

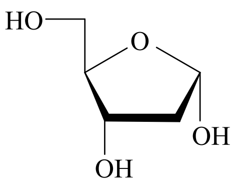
70. Identify the structures having centre of symmetry

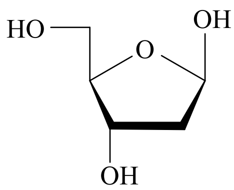
(a)  (b)  (c)  (d) 

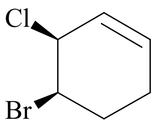
71. Identify the pair of enantiomers

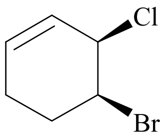
(a)  

(b)  

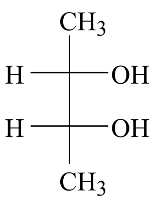
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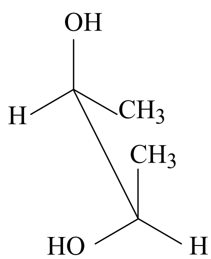


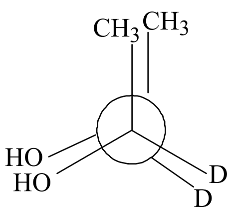
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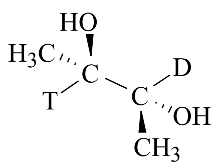


72. Identify the structure of Erythro-butane-2, 3-diol

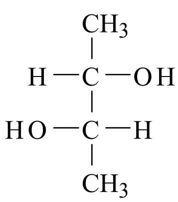
(a) 

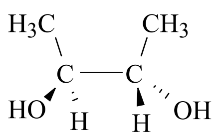
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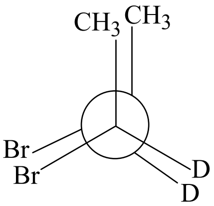
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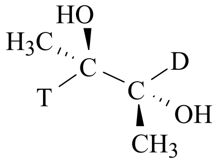
(d) 

73. Identify the structure of Threobutane-2,3-diol

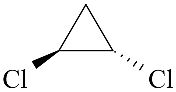
(a) 

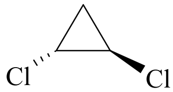
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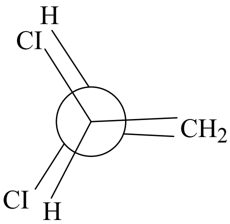
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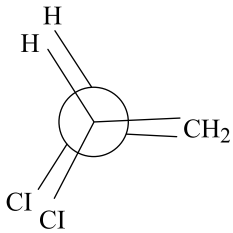
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74. Identify the structure of identical compounds

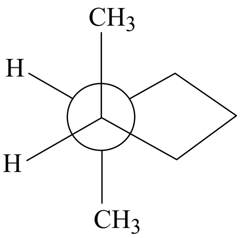
(a) 

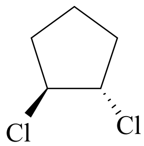
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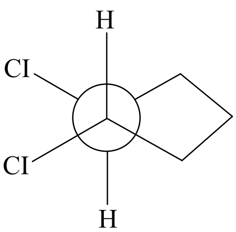
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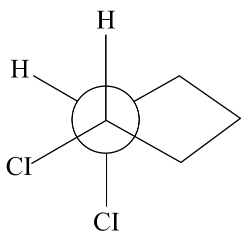
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75. Identify the structure of identical compounds

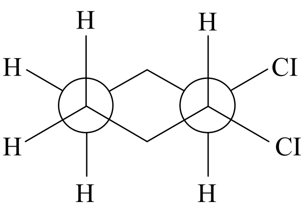
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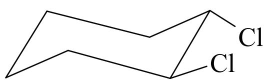
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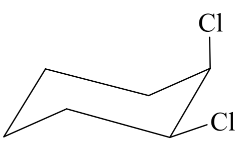
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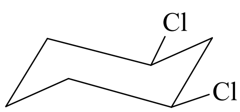
(d) 

76. Identify the structure of enantiomeric compounds

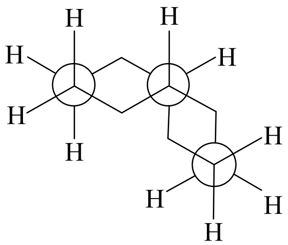
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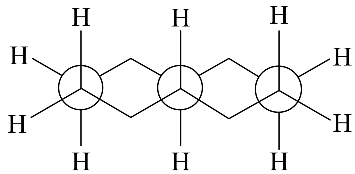
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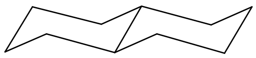
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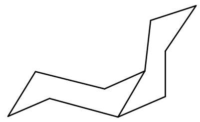
(d) 

77. Identify the structure of transdecaline

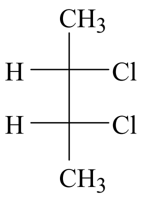
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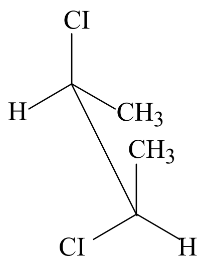
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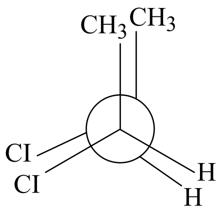
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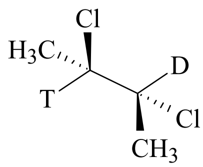
(d) 

78. Identify the compounds that give trans product on reaction with Zn dust and heat

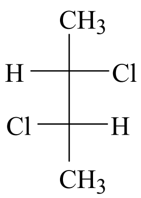
(a) 

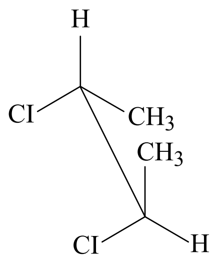
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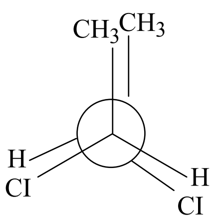
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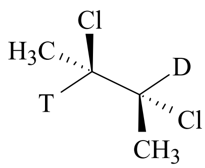
(d) 

79. Identify the compounds that give cis product on reaction with Zn dust and heat

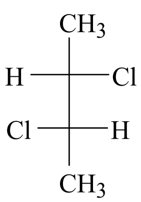
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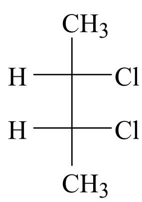
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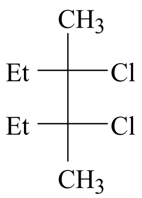
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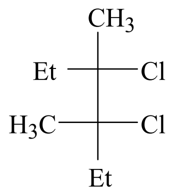
(d) 

80. Identify the compounds that give cis product on reaction with Zn dust and heat

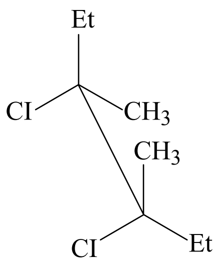
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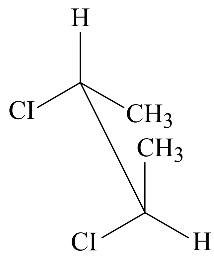
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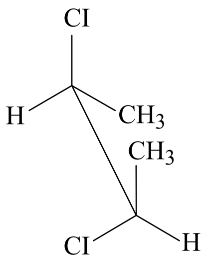
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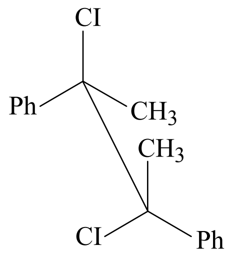
(d) 

81. Identify the compounds that give cis product on reaction with Zn dust and heat

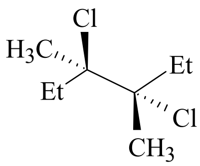
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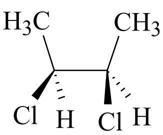
(b) 

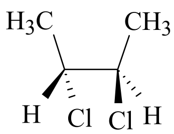
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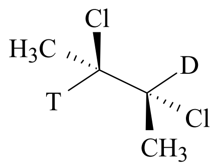
(d) 

82. Identify the compounds that give trans product on reaction with Zn dust and heat

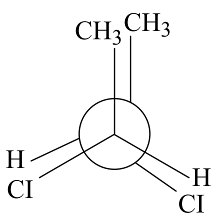
(a) 

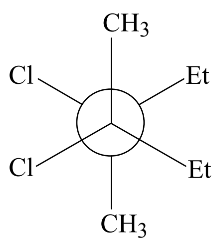
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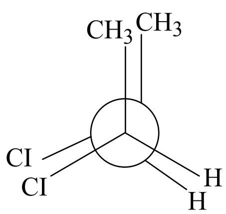
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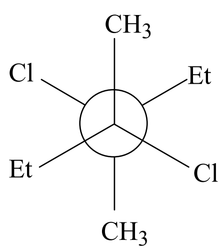
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83. Identify the compounds that give trans product on reaction with Zn dust and heat

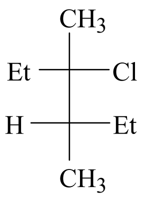
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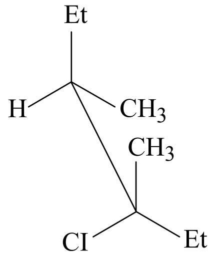
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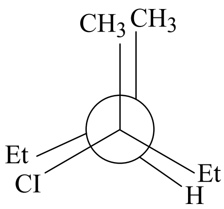
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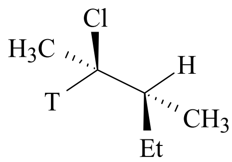
(d) 

84. Identify the compounds that give trans product on reaction with alcoholic KOH and heat

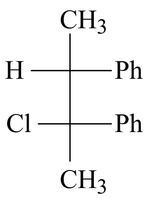
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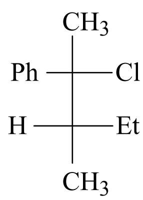
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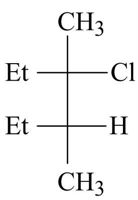
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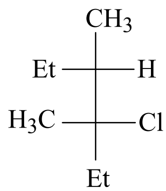
(d) 

85. Identify the compounds that give trans product on reaction with alcoholic KOH and heat

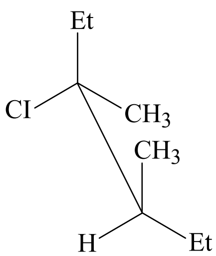
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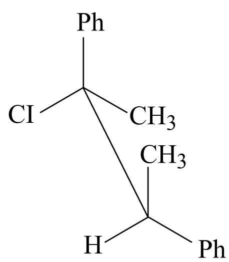
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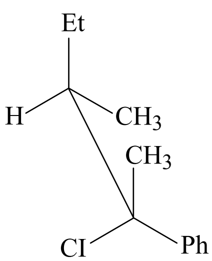
(c) 

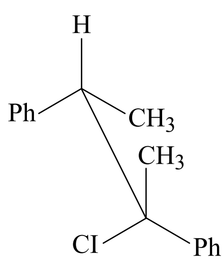
(d) 

86. Identify the compounds that give trans product on reaction with alcoholic KOH and heat

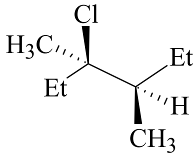
(a) 

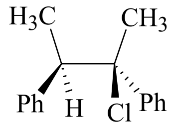
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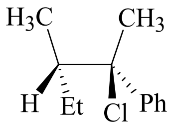
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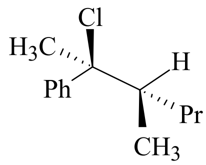
(d) 

87. Identify the compounds that give trans product on reaction with alcoholic KOH and heat

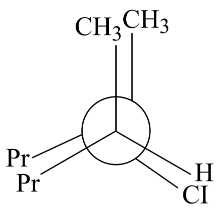
(a) 

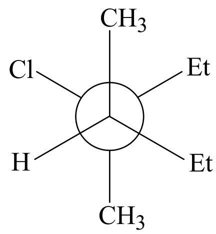
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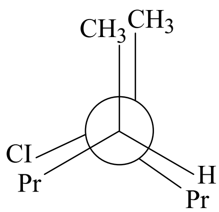
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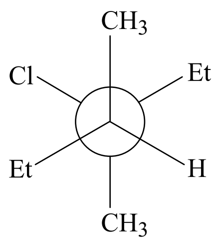
(d) 

88. Identify the compounds that give trans product on reaction with alcoholic KOH and heat

(a) 

(b) 

(c) 

(d) 

Comprehension Type

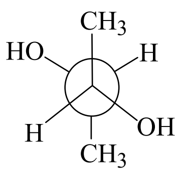
Passage 1

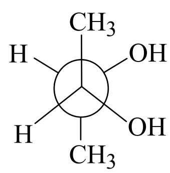
Different spatial arrangements of the atom that result from restricted rotation about a single bond are conformers. The general stability order of these conformer are as follows.

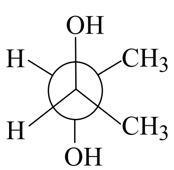
Anti > Gauch > Partially eclipsed > Fully eclipsed

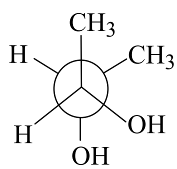
Although anti is more stable than gauch but in some cases gauch is more stable than anti.

89. Which one of the following is the most stable conformer?

(a) 

(b) 

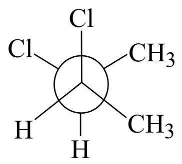
(c) 

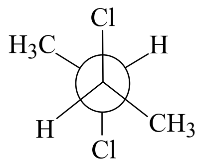
(d) 

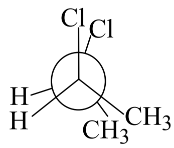
90. Number of possible stable conformers of butane is

(a) 2 (b) 4 (c) 6 (d) Infinite

91. Which of the following are more stable conformers?

(a) 

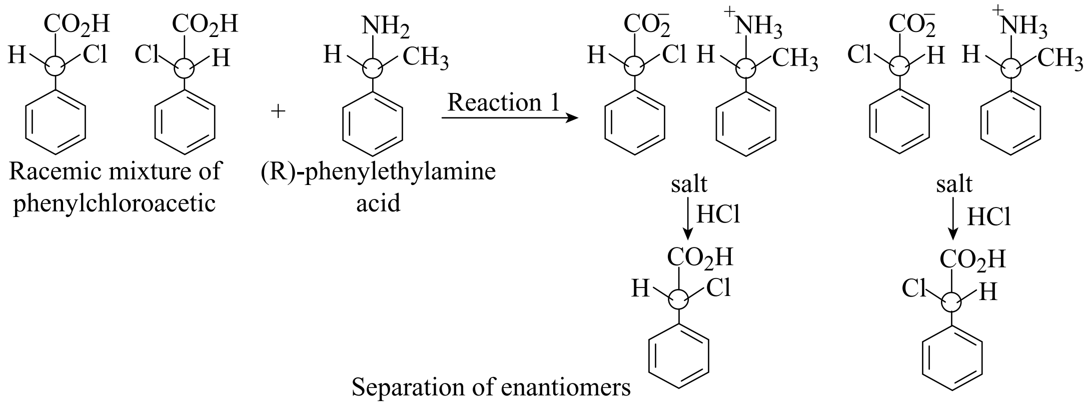
(b) 

(c) 

(d) All of them

Passage 2

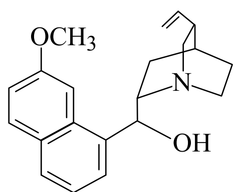
With few exceptions, enantiomers cannot be separated through physical means. When in racemic mixtures, they have the same physical properties. Enantiomers have similar chemical properties as well. The only chemical difference between a pair of enantiomers occurs in reactions with other chiral compounds. Thus resolution of a racemic mixture typically takes place through a reaction with another optically active reagent. Since living organisms usually produce only one of two possible enantiomers, many optically active reagents can be obtained from natural sources. For instance, (S)-(+)-lactic acid can be obtained from animal muscle tissue and (S)-(–)-2-methyl-1-butanol from yeast fermentation.



In the resolution of a racemic acid, a solution of (R)-phenylethylamine is reacted with a racemic mixture of phenylchloroacetic acid to form the corresponding salts. The salts are then separated by careful fractional crystallisation. Hydrochloric acid is added to the separated salts, and the respective acids are precipitated from their solutions.

Resolution of a racemic base can be accomplished in the same manner with tartaric acid.

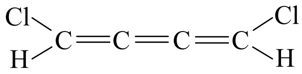
92. Quinine, a natural antimalarial, is commonly used as an optically active reagent to resolve acidic enantiomers. How many chiral carbons exist in the quinine molecule drawn below?



Quinine

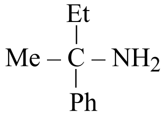
(a) 5 (b) 2 (c) 3 (d) 4

93. Which of the following compounds might be used to resolve a racemic mixture of acidic enantiomers?

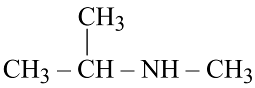
(a) 

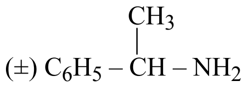
(b) $CH_3–CH_2–CH_3$

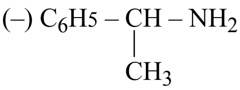
(c) $CH_3–CH_2–CH_2–CH_3$

(d) 

94. Which of the following amines could in principle be used as a resolving agent for a racemic carboxylic acid?

(a) 

(b) 

(c) 

(d) CH_3NH_2

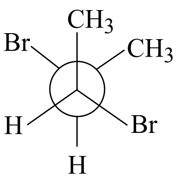
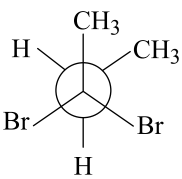
Passage 3

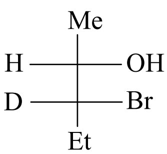
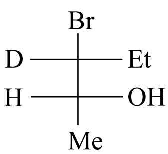
Stereoisomers are compounds that have same sequence of covalent bonds but differ in the relative dispositions of their atoms in space. Geometrical and optical isomers are the two important types of configurational isomers.

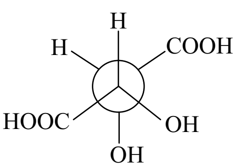
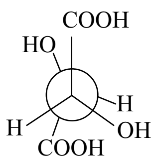
The compound with double bonds or ring structure has restricted rotation, so exists in two geometrical forms. The double bonds in larger rings can also cause geometrical isomerism. The optical isomers rotate the plane of plane-polarised light. A sp^3-hybridised carbon atom bearing four different types of substituents is called an asymmetric centre of chiral centre. A chiral object or molecule cannot be superimposed on its mirror image. Stereoisomers that are mirror images of each other are called enantiomers. The stereoisomers that are not mirror images of each other are called diastereomers. Diastereomers have different physical properties.

A racemic mixture is optically inactive and contains equal amounts of both the enantiomers. Resolution refers to method of separating a racemic mixture into two pure enantiomers. A meso compound is an optically inactive stereoisomer, which is achiral due to the presence of an internal plane of symmetry of centre of symmetry within the molecule.

95. The pair showing identical species is

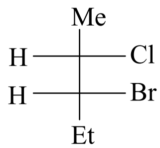
(a)  and 

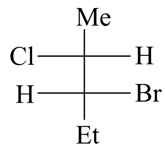
(b)  and 

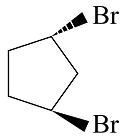
(c)  and 

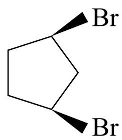
(d) None of these

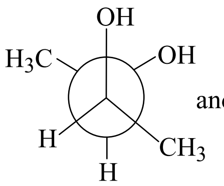
96. Which of the following pairs are diastereomers?

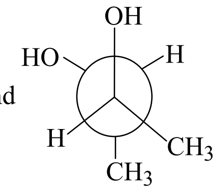
(a) 

and 

(b) 

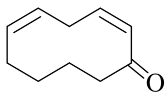
and 

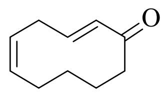
(c) 

and 

(d) All of them

97. The following two compounds are

(i) 

(ii) 

(a) Identical
(b) Diastereomers
(c) Positional isomers
(d) Enantiomers

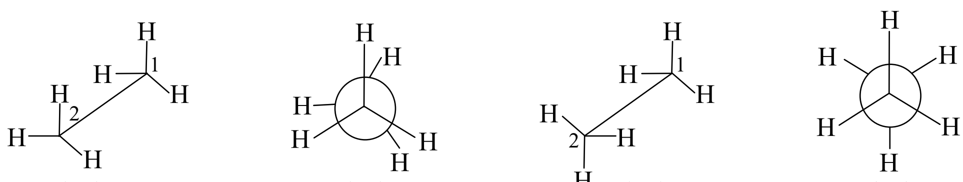
Passage 4

Isomers that have the same skeletons (that is, with component atoms attached in the same sequence) but differ from each other with relative positions of some atoms in three-dimensional space by virtue of rotation about σ bonds are called **conformational isomers or conformers.**

A quantitative description that relates relative atomic positions to the changes in potential energy during rotation about a σ bond describes the energetics of conformational interconversion, a process known as **conformational analysis**.

Rotation about ($C \overset{\sigma}{-} C$) bond in ethane can give various conformers:

In structure A_1 or B_1, C–H flagpoles at C-1 completely overlap each other at C-2. This form is called **eclipsed conformation**.



(A_1) (B_1) (A_2) (B_2)

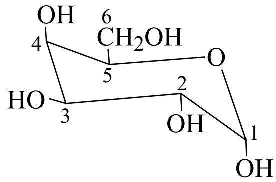
In structure A_2 or B_2, C—H flagpoles at C-1 is fixed at 60° dihedral angle so that it is exactly between two C–H flagpoles at C–2. This is called staggered conformation.

- Various other structures in between eclipsed and staggered conformations are called **skew conformation**.
- Structures B_1 and B_2 show the orientations of the hydrogens on the front carbon relative to those on the back carbon, these are called **Newman projections**.
- Structures A_1 and A_2 are called **Sawhorse projections**.

98. Among the following conformers, which has highest potential energy for n-butane (along C_2–C_3 bond rotation)?

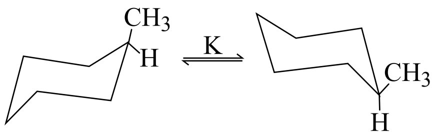
(a) Skew
(b) Fully eclipsed
(c) Staggered
(d) Partially eclipsed

99. In the following chair conformer correct orientation of –OH groups is/are



(a) OH groups at C_1, C_2 and C_4 are axial
(b) OH groups at C_1 and C_2 are axial
(c) OH groups at C_1 and C_4 are axial
(d) OH groups at C_1, C_2 and C_4 are equatorial

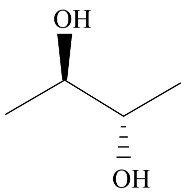
100. In the following equilibrium, the value of "K" is

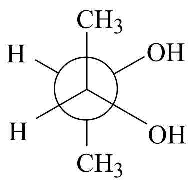


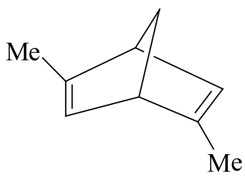
(a) K < 1 (b) K > 1 (c) K = 1 (d) None of these

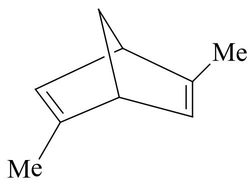
Passage 5

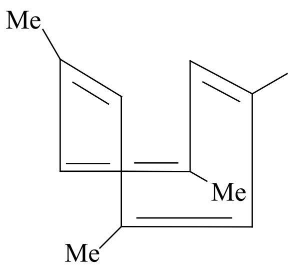
Consider the following pairs of compounds

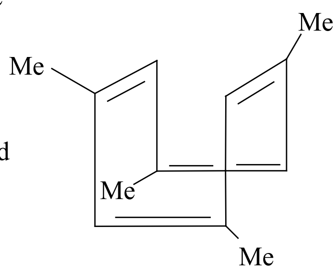
(i) 

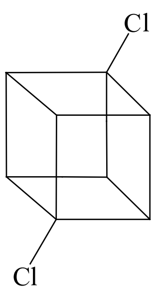
and 

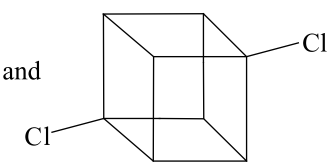
(ii) 

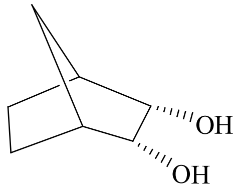
and 

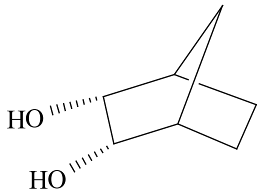
(iii) 

and 

(iv) 

and 

(v) 

and 

101. Identical pair of compounds is/are

(a) i and ii (b) ii and iii (c) iv and v (d) i and v

102. Both compounds in above pair are meso

(a) 1st pair (b) 2nd pair (c) 5th pair (d) 4th pair

103. Diastereoisomeric pair is

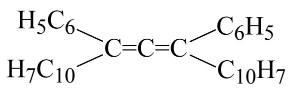
(a) 1st pair (b) 2nd pair (c) 3rd pair (d) 4th pair

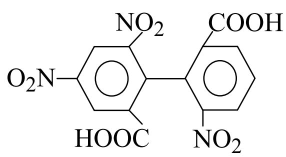
Passage 6

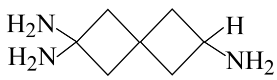
Presence of chiral carbon in organic compound is neither a necessary nor a sufficient condition showing optical activity. The chirality, i.e., dissymmetry of a molecule as a whole is the necessary condition for optical activity.

104. Which of these compounds will NOT show optical activity?

(a) CH_3–CHOH–CH_2–CH_3

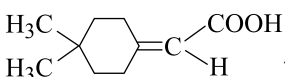
(b) 

(c) 

(d) 

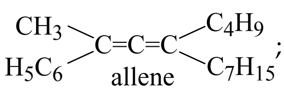
105. Which of the following pairs is correctly matched?

(a) $CH_3-CH=C=CH_2$; optically active (allene)

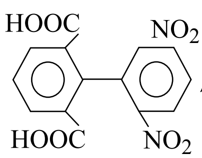
(b) 

; optically active

Alkylidene

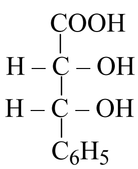
(c) 

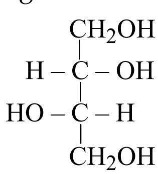
; optically active

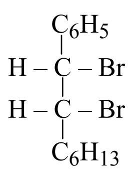
(d) 

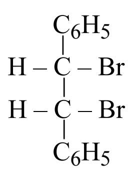
; optically active

106. Which one of the following is an achiral molecule?

(a) 

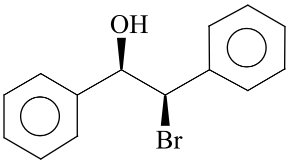
(b) 

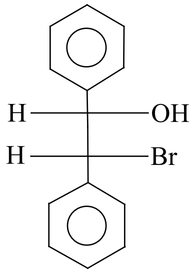
(c) 

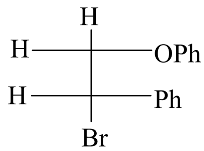
(d) 

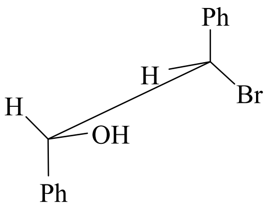
Passage 7

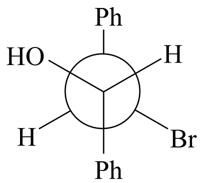
Observe the given molecule/s

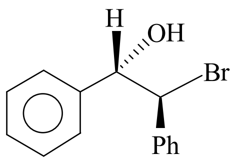
(i) 

(ii) 

(iii) 

(iv) 

(v) 

(vi) 

107. Correct statement is

(a) i and ii are enantiomers
(b) iii and v are diastereomers
(c) i and iv are identical
(d) i and vi are diastereomers

108. Diastereomeric pair is

(a) i and ii (b) i and vi (c) ii and v (d) iii and vi

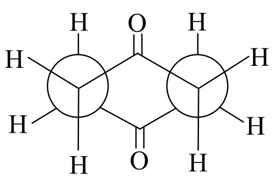
109. If Br is attatched in place of –OH group in structure "V" (with same stereochemistry) then resultant structure is

(a) Meso
(b) Threo
(c) Structure has odd degree of unstaturation
(d) Structure is identical to (i) compound

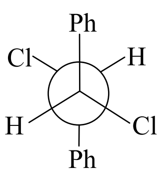
Matrix Type

Match the columns:

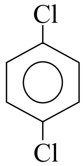
110. **Column I** **Column II**

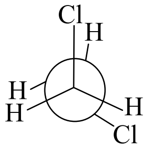
(a) 

(p) Compounds give positional isomerisation with 1,2-dichloro benzene.

(b) 

(q) Degree of unsaturation in the given compound is even [excluding zero value]

(c) 

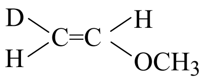
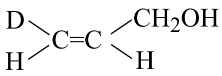
(d) 

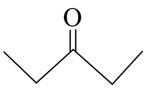
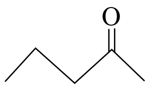
(r) Given compound or conformer has zero dipole moment.

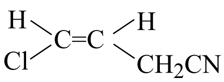
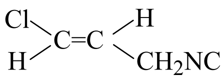
(s) Net dipole of one mole of compound is nonzero.

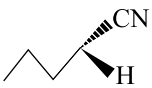
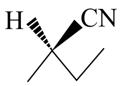
(t) Compound has ketone functional group.

111. Column I (Compound)

(a)  and 

(b)  and 

(c)  and 

(d)  and 

Column II (Isomerism)

(p) Functional isomers

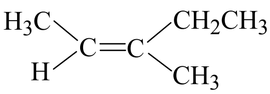
(q) Geometrical isomers

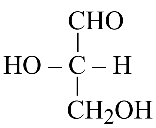
(r) Position isomers

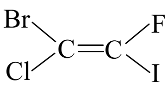
(s) Chain isomers

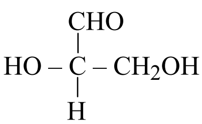
(t) Metamer

112. Column I (Structure)

(a) 

(b) 

(c) 

(d) 

Column II (Configuration)

(p) E

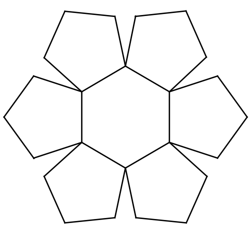
(q) Z

(r) R

(s) S

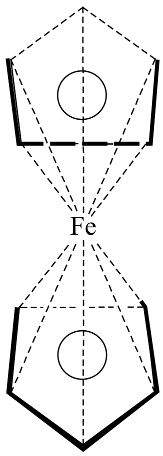
(t) Plane of symmetry

113. Column I

(a) 

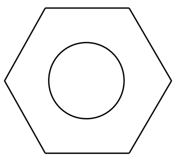
Column II

(p) Plane of symmetry absent

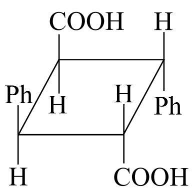
(b) 

Ferrocene (staggered)

(q) C_6

(c) 

(r) S_6

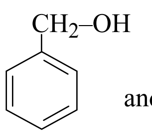
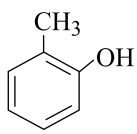
(d) 

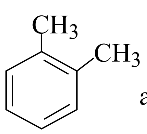
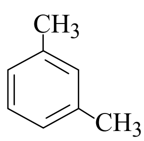
(s) C_i/COS

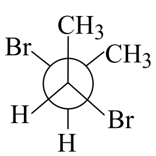
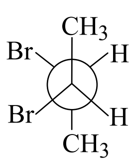
(t) C_5

114. Column I (Compounds) | **Column II (Type of isomerism)**

(a) $CH_3\text{–}CH_2\text{–}CH_2\text{–}\overset{\overset{\Large O}{\|}}{C}\text{–}CH_3$ and $CH_3\text{–}CH_2\text{–}\overset{\overset{\Large O}{\|}}{C}\text{–}CH_2\text{–}CH_3$

(b)  and 

(c)  and 

(d)  and 

(p) Positional

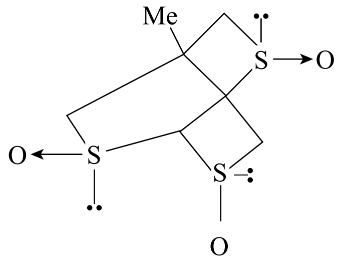
(q) Conformational

(r) Metamerism

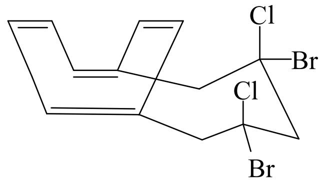
(s) Functional

(t) Optical isomerism

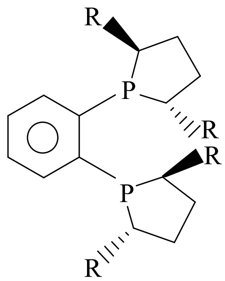
115. Column I | **Column II**

(a) 

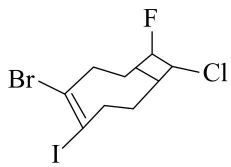
(p) Optically inactive compound

(b) 

(q) Optically active compound

(c) 

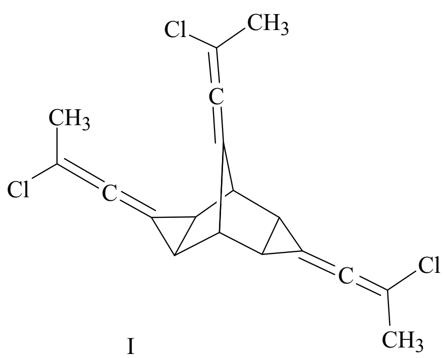
(r) Meso compound

(d) 

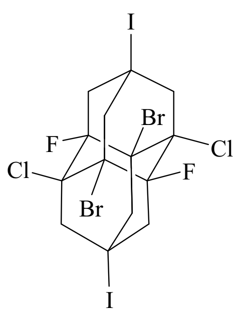
(s) Axis of symmetry present

(t) Asymmetric compound

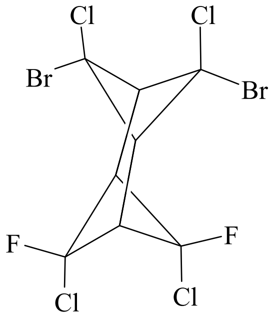
116. Column I | **Column II**

(a) 

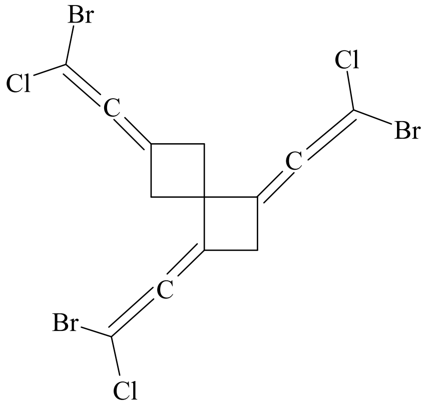
(p) Optically inactive compound

(b) 

(q) Optically active compound

(c) 

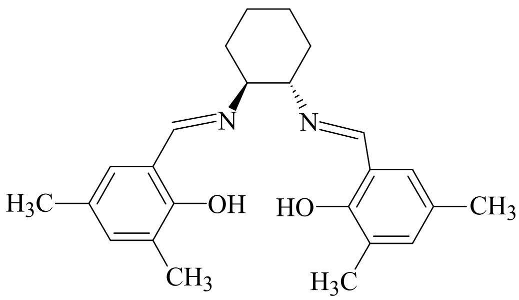
(r) Meso compound

(d) 

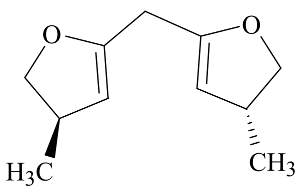
(s) Axis of symmetry present

(t) Asymmetric compound

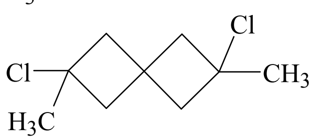
117. Column I **Column II**

(a) 

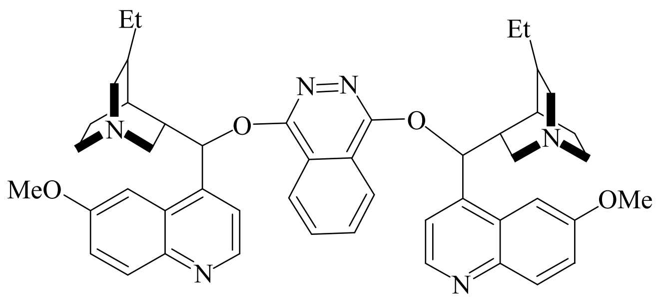
(p) Optically inactive compound

(b) 

(q) Optically active compound

(c) 

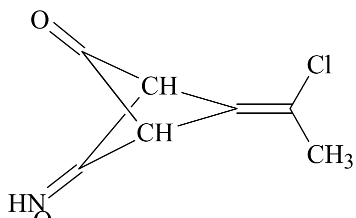
(r) Meso compound

(d) 

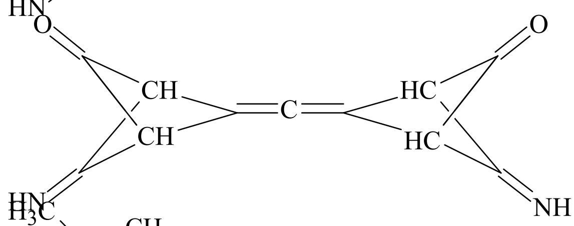
(s) Axis of symmetry present

(t) Dissymmetric compound

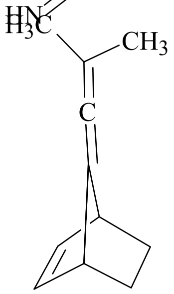
118. Column I **Column II**

(a) 

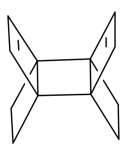
(p) Optically inactive compound

(b) 

(q) Optically active compound

(c) 

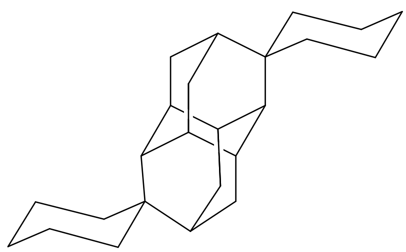
(r) Meso compound

(d) 

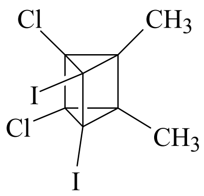
(s) Axis of symmetry present

(t) Asymmetric compound

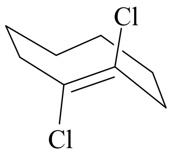
119. Column I **Column II**

(a) 

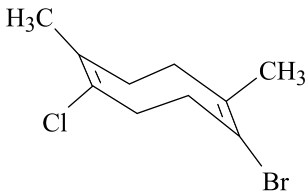
(p) Optically inactive compound

(b) 

(q) Optically active compound

(c) 

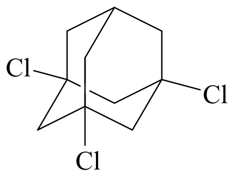
(r) Meso compound

(d) 

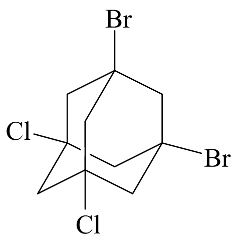
(s) Axis of symmetry present

(t) Asymmetric compound

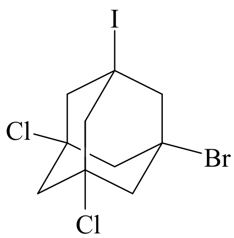
120. Column I **Column II**

(a) 

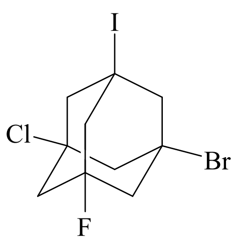
(p) Optically inactive compound

(b) 

(q) Optically active compound

(c) 

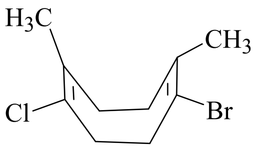
(r) Dissymmetric compound

(d) 

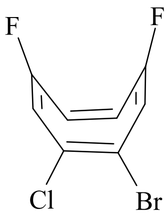
(s) Axis of symmetry present

(t) Asymmetric compound

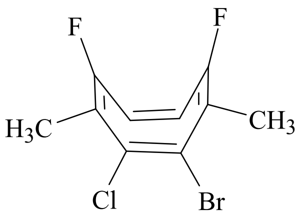
121. Column I | **Column II**

(a) 

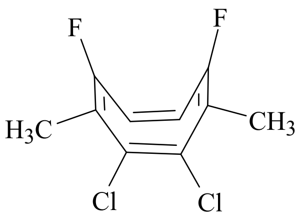
(p) Optically inactive compound

(b) 

(q) Optically active compound

(c) 

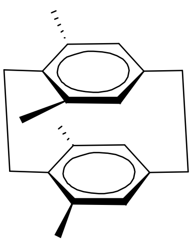
(r) Degree of unsaturation is odd

(d) 

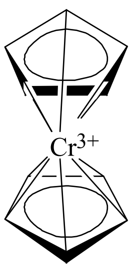
(s) Axis of symmetry present

(t) Asymmetric compound

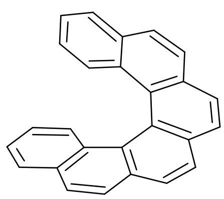
122. Column I | **Column II**

(a) 

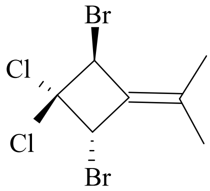
(p) Optically inactive compound

(b) 

(q) Optically active compound

(c) 

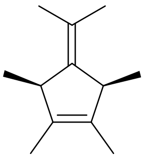
(r) Dissymmetric compound

(d) 

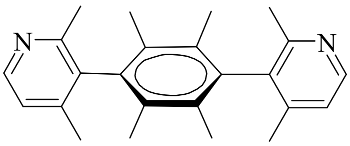
(s) Axis of symmetry present

(t) Asymmetric compound

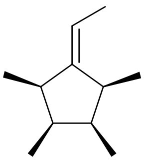
123. Column I **Column II**

(a) 

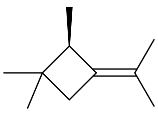
(p) Optically inactive compound

(b) 

(q) Optically active compound

(c) 

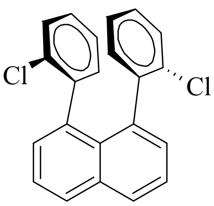
(r) Dissymmetric compound

(d) 

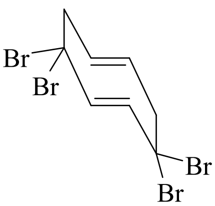
(s) Axis of symmetry present

(t) Asymmetric compound

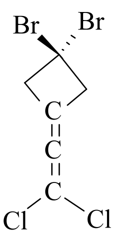
124. Column I **Column II**

(a) 

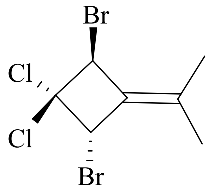
(p) Optically inactive compound

(b) 

(q) Optically active compound

(c) 

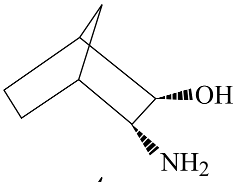
(r) Dissymmetric compound

(d) 

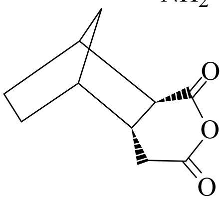
(s) Axis of symmetry present

(t) Asymmetric compound

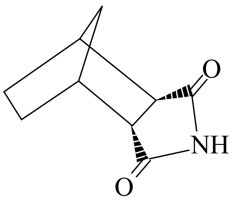
125. Column I **Column II**

(a) 

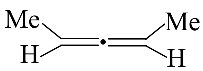
(p) Optically active molecules without chiral centres

(b) 

(q) Optically active molecules with chiral centres.

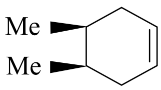
(c) 

(r) Compounds have even number of chiral centres

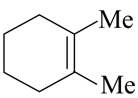
(d) 

(s) Optically inactive molecules

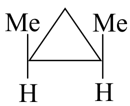
126. Column I **Column II**

(a) 

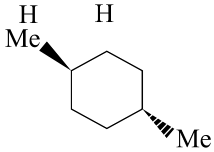
(p) Optically active

(b) 

(q) Optically inactive

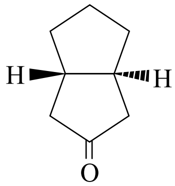
(c) 

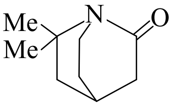
(r) Compounds show geometrical isomerism

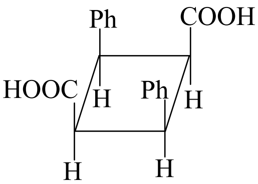
(d) 

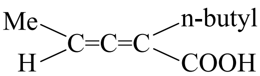
(s) Plane of symmetry

127. Column I | **Column II**

(a)  (p) Molecule has chiral centre

(b)  (q) Molecule is asymmetric

(c)  (r) Molecule is dissymmetric

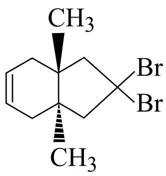
(d)  (s) Molecule is optically inactive

Integer Type

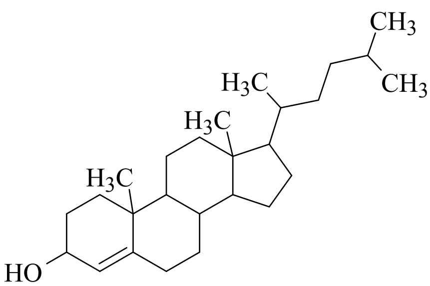
128. $\mu_{obs} = \sum \mu_i x_i$; where μ_i is the dipole moment of stable conformer and x_i is the mole fraction of that conformer of $Z–CH_2–CH_2–Z$ in Newmann's projection. If $\mu_{solution}$ or μ_{net} = 1 D and mole fraction of antiform = 0.82, find μ_{Gauche}.

129. Number of primary amine possible for $C_4H_{11}N$ is

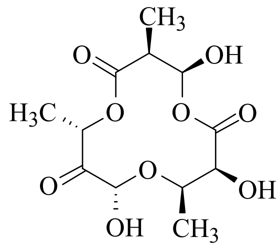
130. How many chiral centres are present in the following compound?



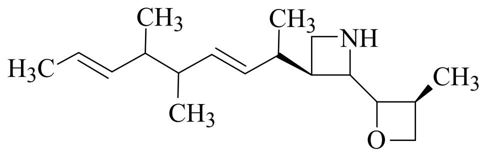
131. How many chiral centres are present in the following compound?



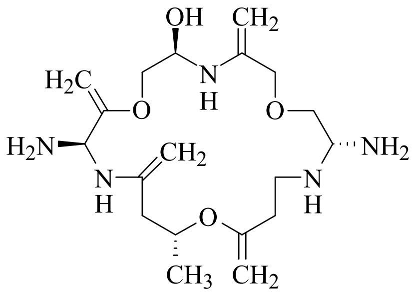
132. How many stereoisomers are possible for the following compound?



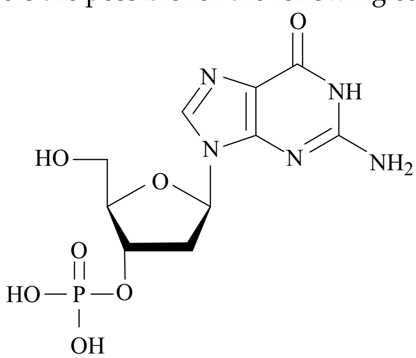
133. How many stereoisomers are possible for the following compound?



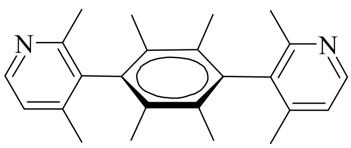
134. How many stereoisomers are possible for the following compound?

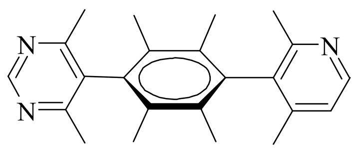


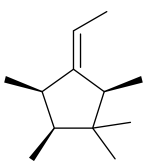
135. How many stereoisomers are possible for the following compound?



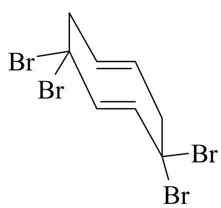
136. How many compounds are optically active?

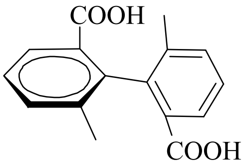
(a) 

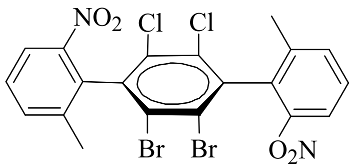
(b) 

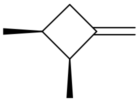
(c) 

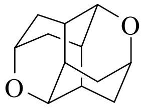
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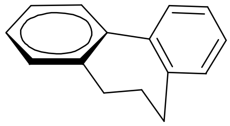
(d) 

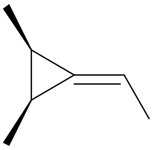
(e) 

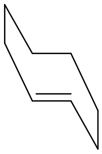
(f) 

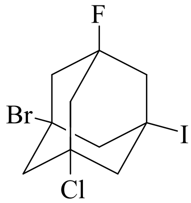
(g) 

(h) 

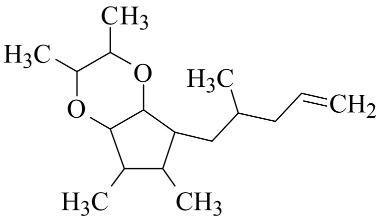
(i) 

(j) 

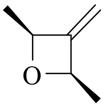
(k) 

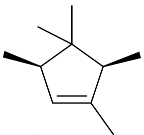
(l) 

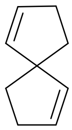
137. How many stereocentres are possible for the following compound?

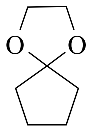


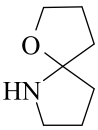
138. How many compounds are optically inactive?

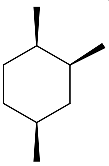
(a) 

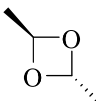
(b) 

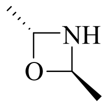
(c) 

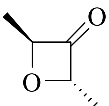
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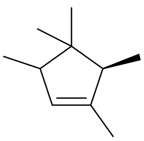
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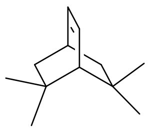
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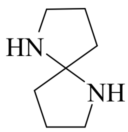
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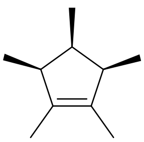
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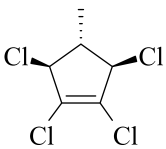
(i) 

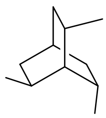
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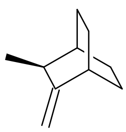
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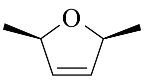
(l) 

(m) 

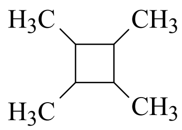
(n) 

(o) 

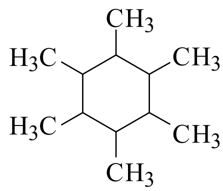
(p) 

(q) 

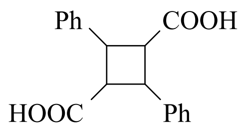
139. How many geometrical isomers are possible for the following compound?



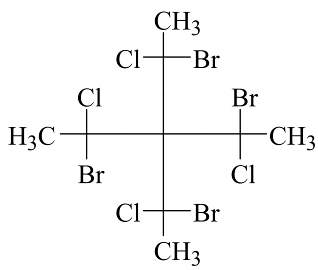
140. How many geometrical isomers are possible for the following compound?



141. How many geometrical isomers are possible for the following compound?



142. How many steroisomers are possible for the following compound?



Answer Keys

LEVEL 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
b	a	d	d	b	b	b	a	b	c	d	c	c	a	c
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
c	b	d	a	d	c	ac	ab	d	d	d	d	d	a	c
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
d	a	b	d	b	a	b	c	d	d	c	a	b	c	d
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
d	a	d	c	a	a	d	a	b	d	c	d	b	c	b
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
c	a	c	d	a	c	b	b	b	a	d	c	c	d	c
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
a	c	b	a	b	b	a	a	b	b	d	c	a	d	b
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
c	d	b	b	a	d	b	a	d	b	a	a	a	d	c
106	107	108	109	110	111	112	113	114	115	116				
b	b	c	a	c	a	a	b	b	c	c				

LEVEL 2

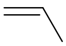
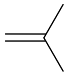
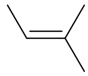
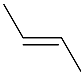
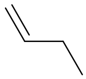
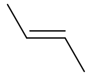
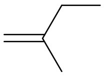
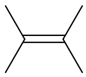
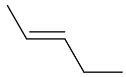
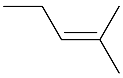
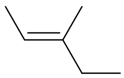
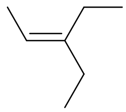
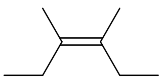
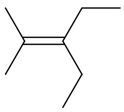
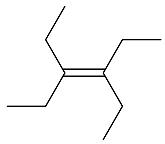
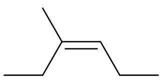
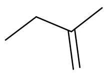
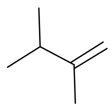
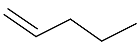
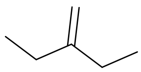
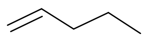
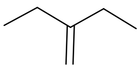
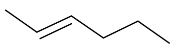
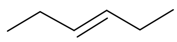
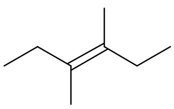
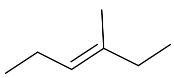
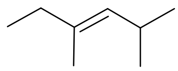
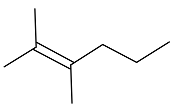
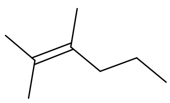
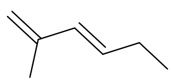
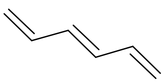
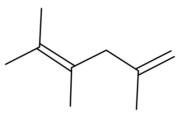
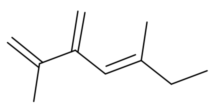
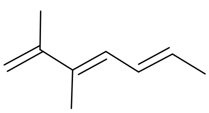
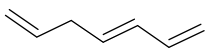
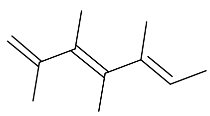
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a	b	c	c	d	b	b	b	abd	c	b	b	b	bc	abd
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46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
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cd	ac	a	a	cd	a	a	d	ab	bc	ad	ab	ab	bc	bc
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
ab	bc	abcd	abc	acd	ab	abd	cd	d	ac	d	acd	ad	b	a
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
b	d	d	c	d	ab	b	b	c	b	c	c	a	d	c
106	107	108	109	110(a)	110(b)	110(c)	110(d)	111(a)	111(b)	111(c)	111(d)	112(a)	112(b)	112(c)
d	c	a	a	rst	qrs	pqr	s	p	rt	p	s	qt	s	pt

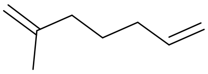
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r	rs	st	qrs	ps	pr	s	p	t	qs	pr	qs	qt	pr	pr
116(c)	116(d)	117(a)	117(b)	117(c)	117(d)	118(a)	118(b)	118(c)	118(d)	119(a)	119(b)	119(c)	119(d)	120(a)
ps	qt	qst	qst	qst	pr	qt	qt	pr	prs	prs	pr	qs	qt	ps
120(b)	120(c)	120(d)	121(a)	121(b)	121(c)	121(d)	122(a)	122(b)	122(c)	122(d)	123(a)	123(b)	123(c)	123(d)
ps	p	qt	qrt	qrt	qrt	pr	ps	ps	qrs	qrs	p	ps	qt	qt
124(a)	124(b)	124(c)	124(d)	125(a)	125(b)	125(c)	125(d)	126(a)	126(b)	126(c)	126(d)	127(a)	127(b)	127(c)
qrs	qrs	ps	qrs	qr	qr	rs	p	qrs	qs	qsr	qrs	pr	pq	s
127(d)	128	129	130	131	132	133	134	135	136	137	138	139	140	141
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142														
5														

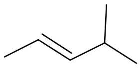
WORKBOOK EXERCISES

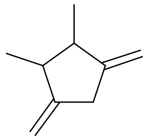
EXERCISE 1

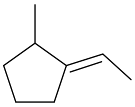
Identify molecules that show Geometrical Isomerism

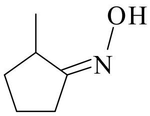
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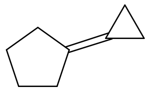
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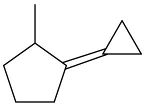
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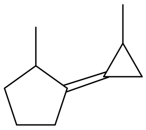
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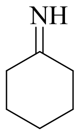
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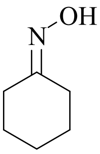
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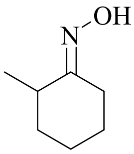
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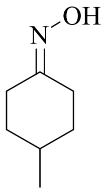
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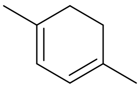
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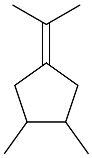
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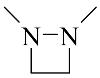
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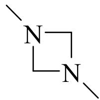
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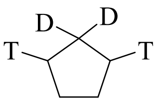
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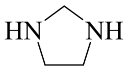
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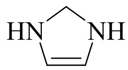
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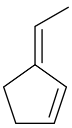
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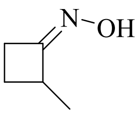
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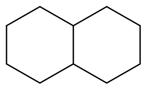
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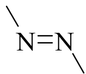
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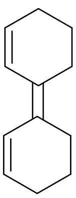
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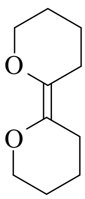
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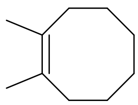
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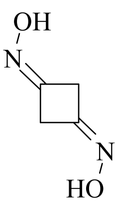
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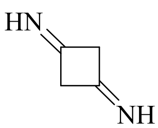
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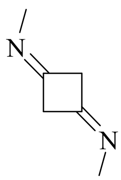
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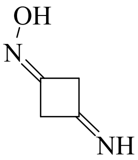
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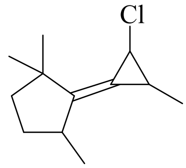
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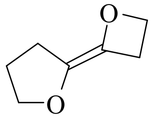
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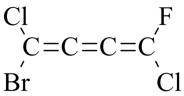
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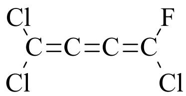
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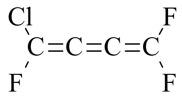
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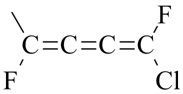
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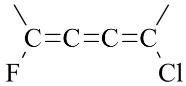
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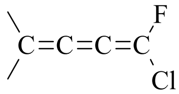
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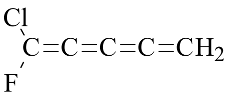
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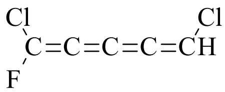
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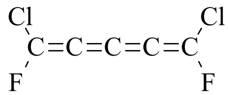
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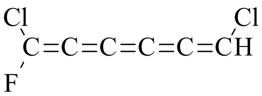
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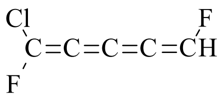
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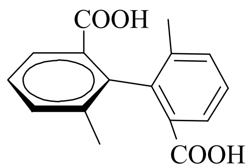
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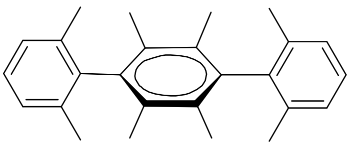
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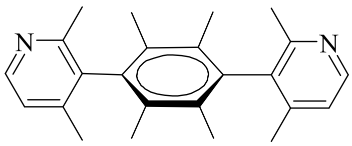
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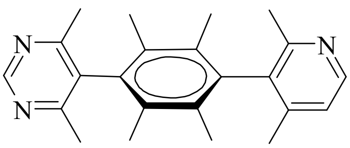
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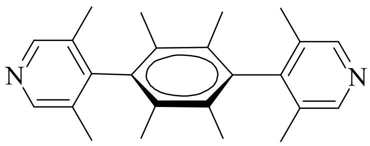
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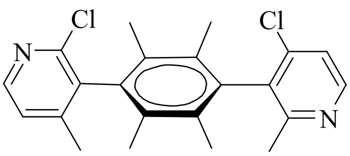
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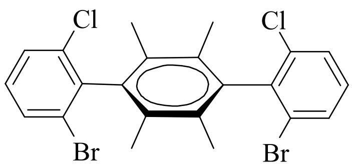
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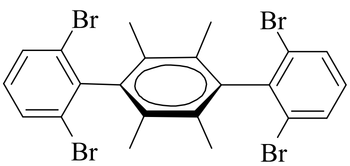
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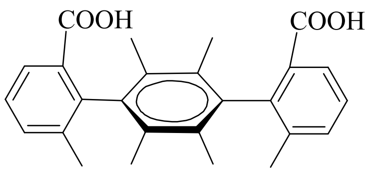
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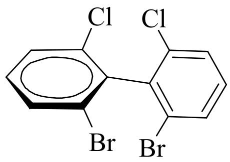
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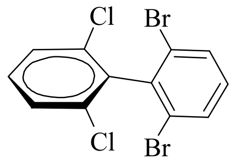
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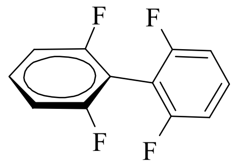
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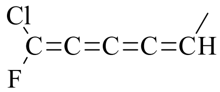
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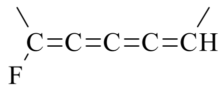
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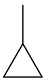
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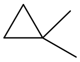
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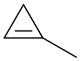
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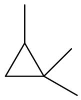
EXERCISE 2

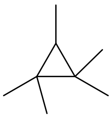
Identify molecules that show Geometrical Isomerism

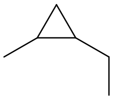
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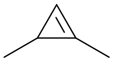
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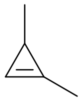
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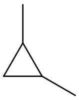
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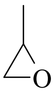
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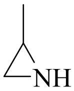
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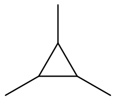
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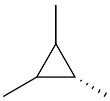
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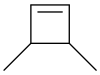
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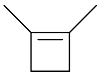
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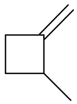
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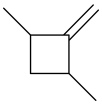
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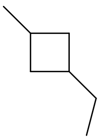
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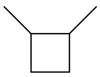
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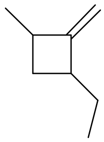
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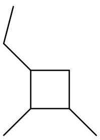
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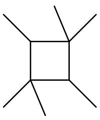
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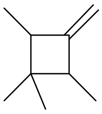
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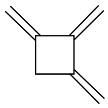
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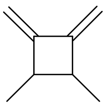
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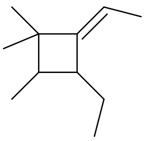
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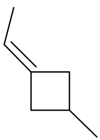
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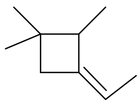
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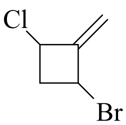
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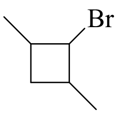
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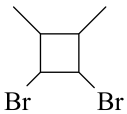
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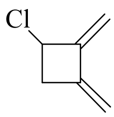
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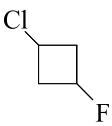
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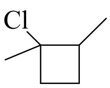
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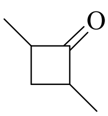
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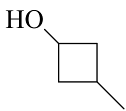
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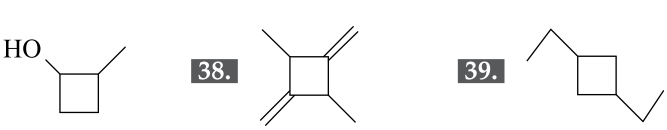
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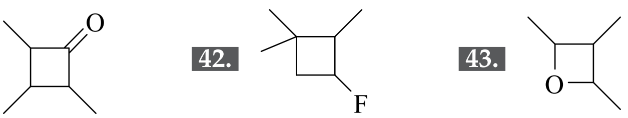
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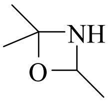
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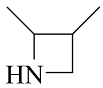
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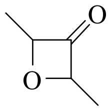


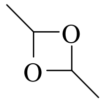
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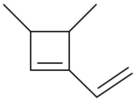


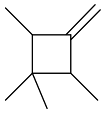
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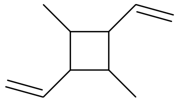
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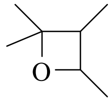
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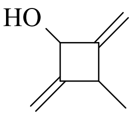
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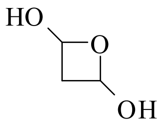
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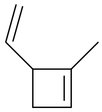
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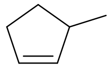
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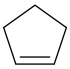
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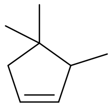
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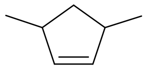
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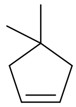
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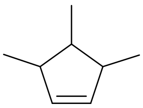
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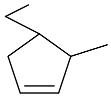
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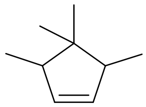
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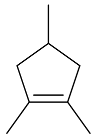
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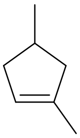
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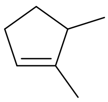
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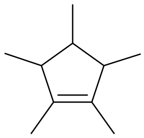
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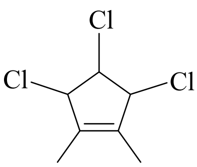
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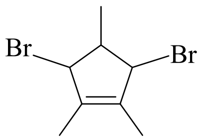
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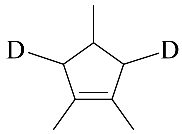
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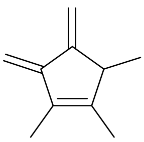
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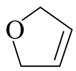
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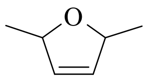
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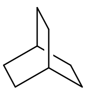
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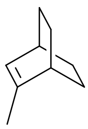
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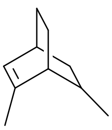
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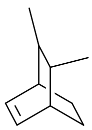
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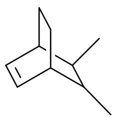
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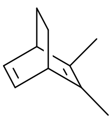
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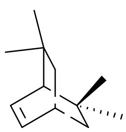
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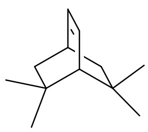
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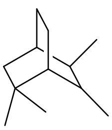
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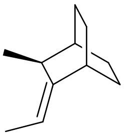
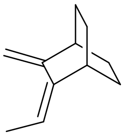
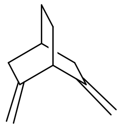
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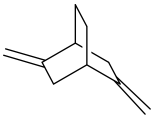
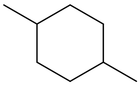
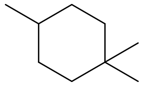
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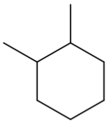
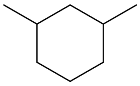
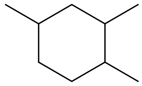
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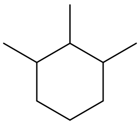
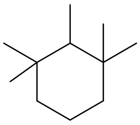
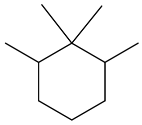
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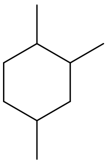
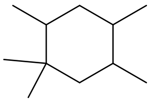
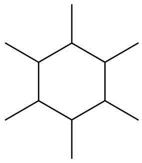
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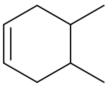
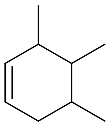
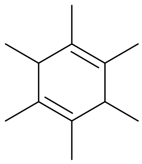
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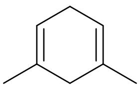
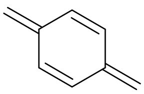
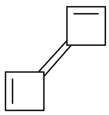
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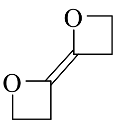
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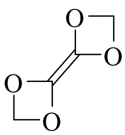
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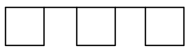
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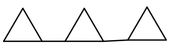
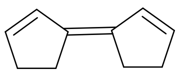
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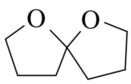
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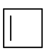
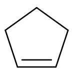
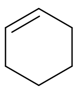
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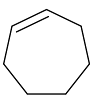
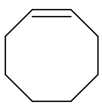
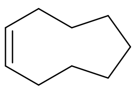
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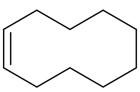
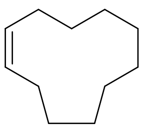
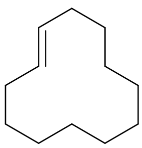
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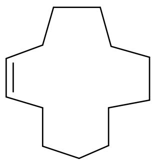
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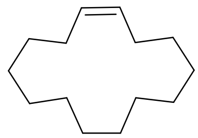
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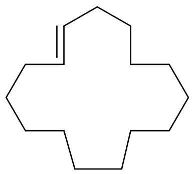
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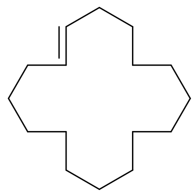
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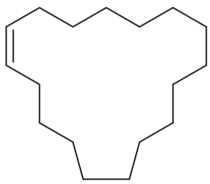
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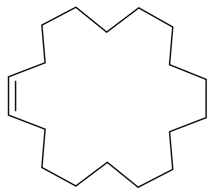
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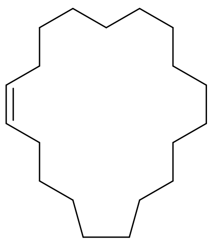
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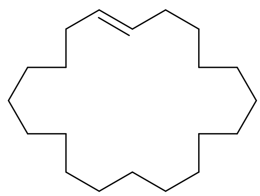
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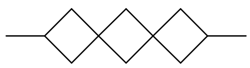
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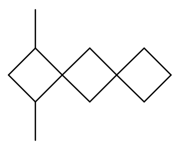
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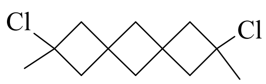
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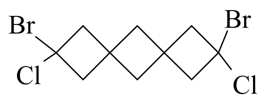
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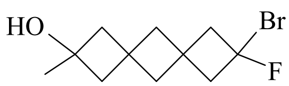
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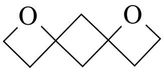
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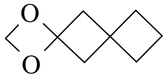
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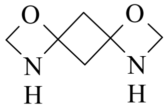
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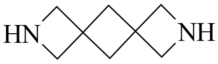
EXERCISE 3

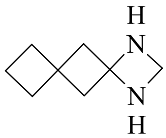
Identify molecule give G.I.

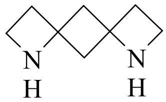
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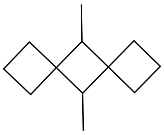
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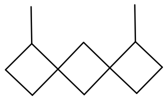
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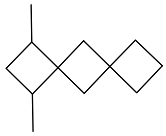
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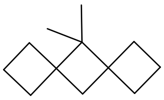
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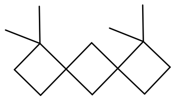
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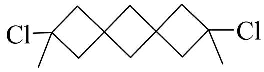
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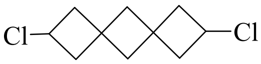
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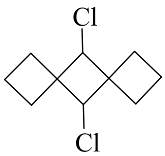
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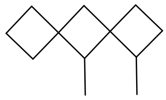
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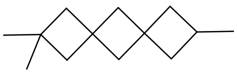
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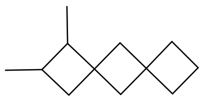
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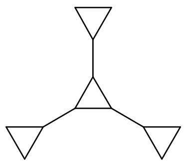
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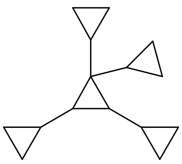
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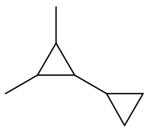
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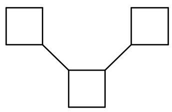
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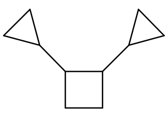
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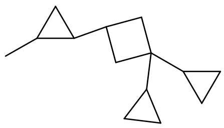
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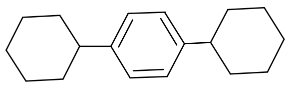
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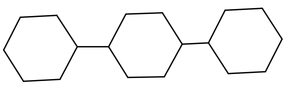
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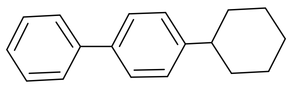
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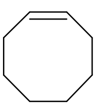
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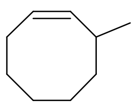
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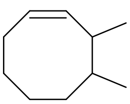
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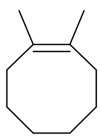
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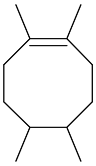
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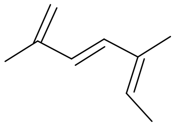
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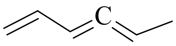
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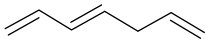
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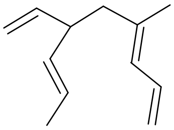
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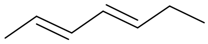
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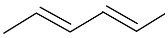
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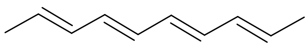
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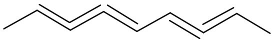
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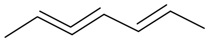
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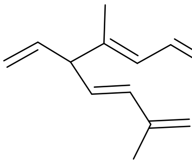
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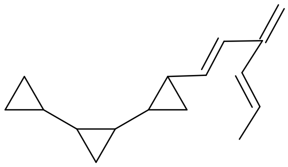
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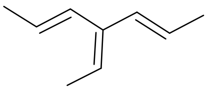
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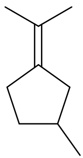
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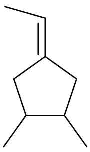
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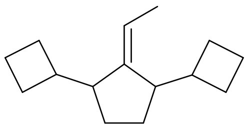
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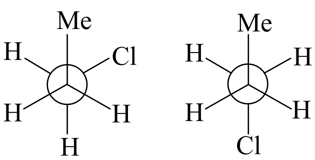
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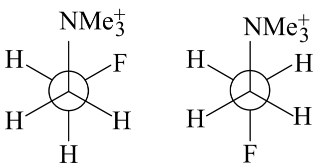
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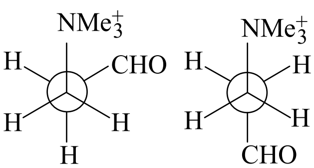
Identify stable conformer

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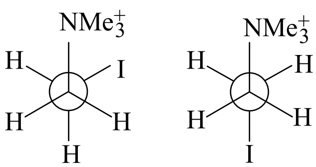
i ii

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i ii

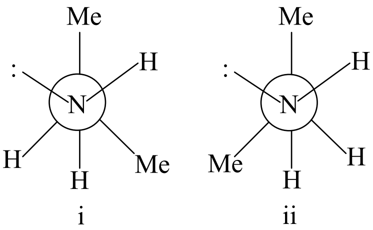
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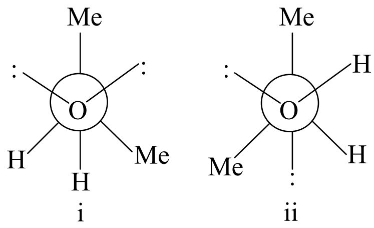
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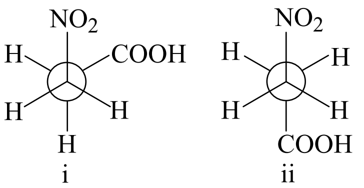
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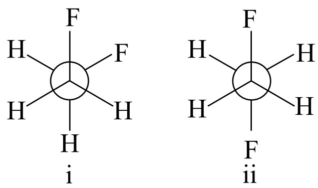
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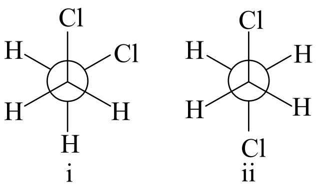
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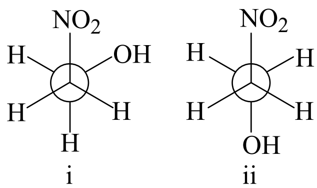
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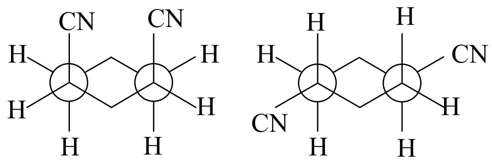
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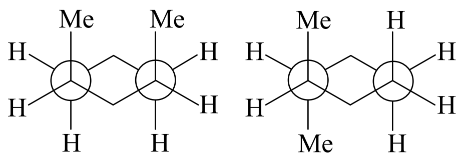
EXERCISE 4

Identify Isomeric Relationship between pair of Compounds

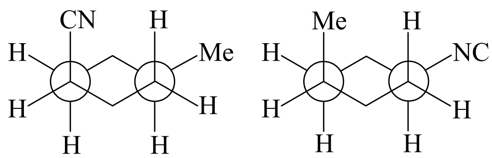
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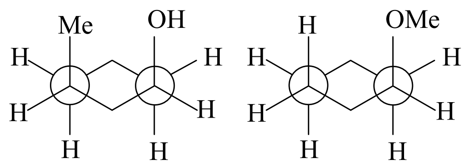
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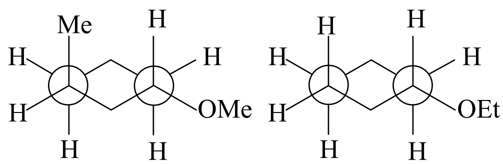
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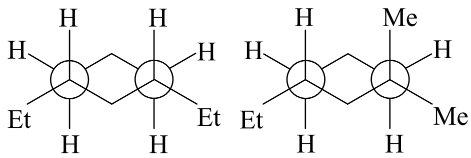
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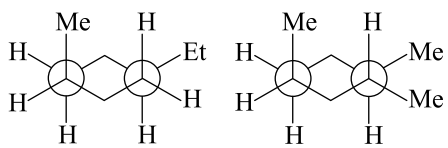
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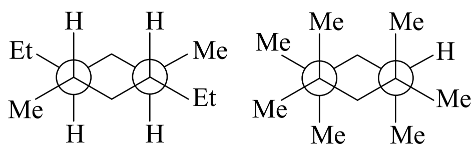
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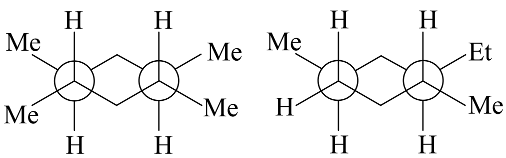
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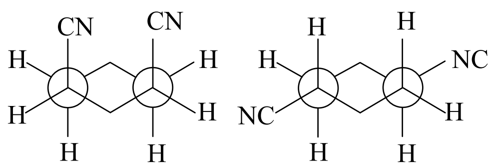
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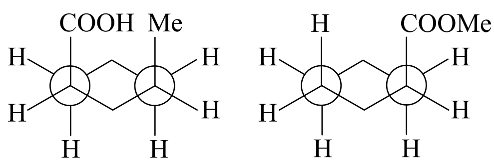
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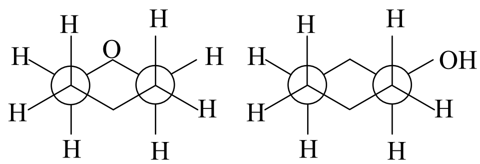
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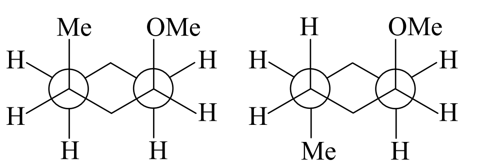
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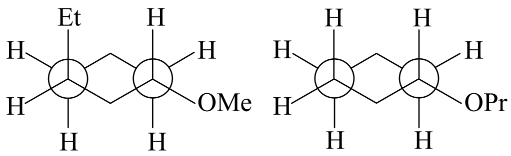


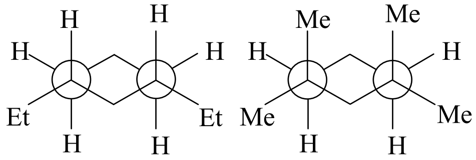
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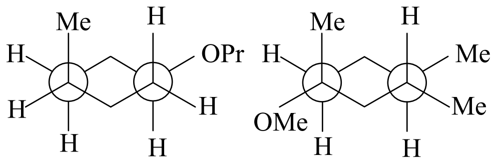


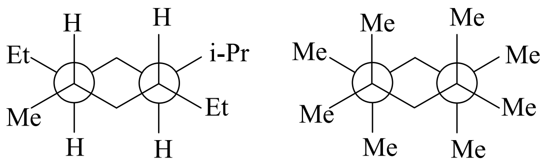
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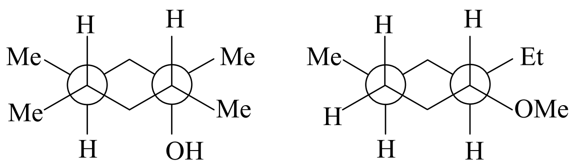


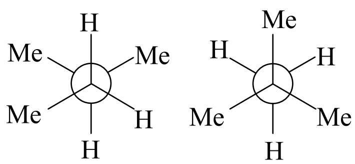
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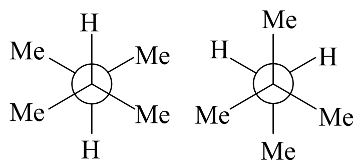
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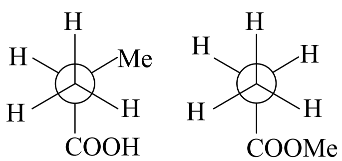
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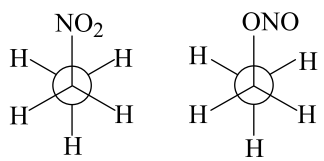
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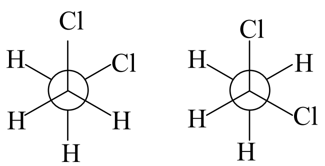
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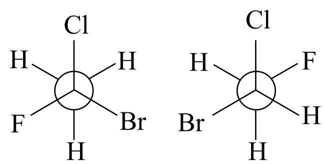
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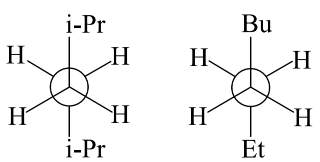
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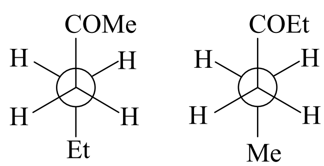
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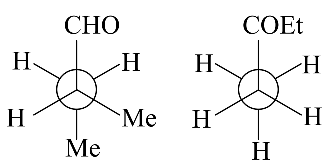
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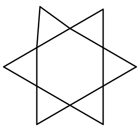
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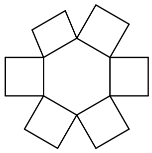
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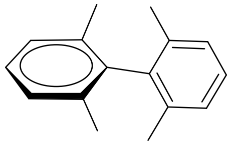
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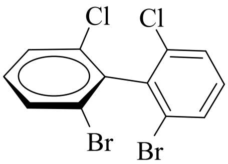
EXERCISE 5

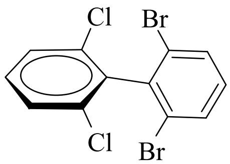
Identify optically active compounds

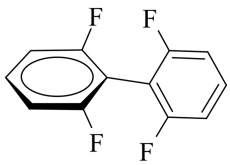
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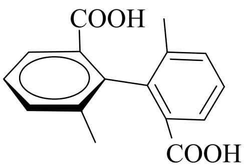
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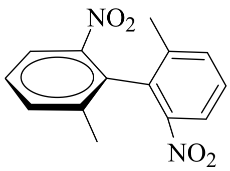
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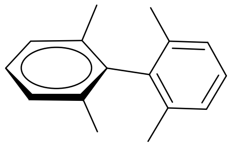
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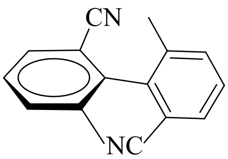
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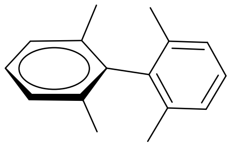
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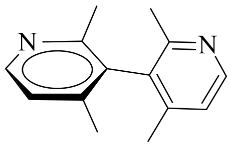
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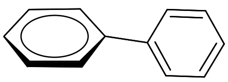
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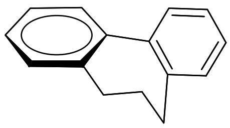
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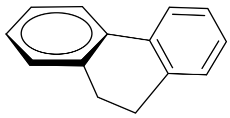
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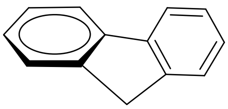
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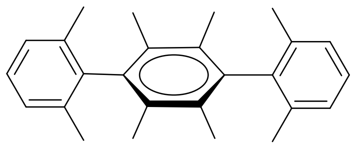
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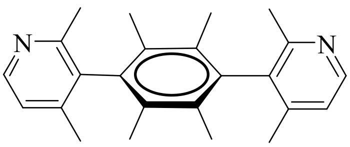
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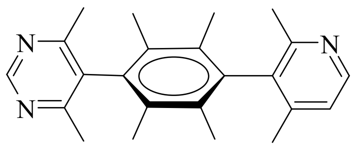
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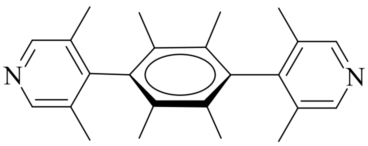
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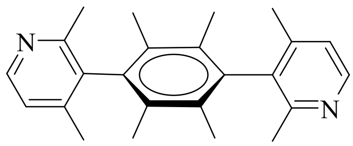
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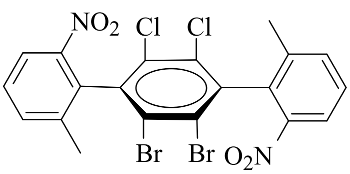
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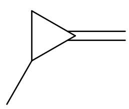
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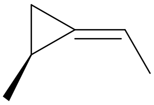
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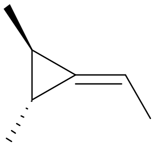
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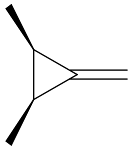
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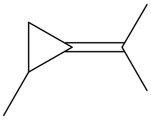
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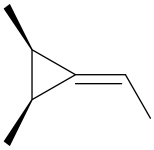
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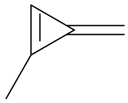
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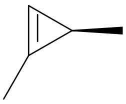
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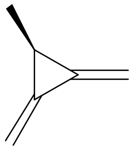
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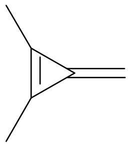
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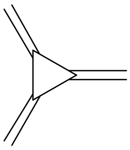
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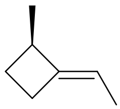
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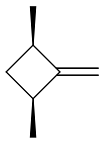
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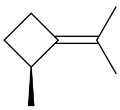
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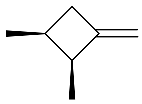
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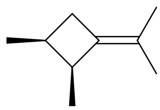
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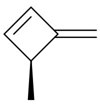
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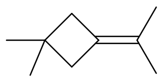
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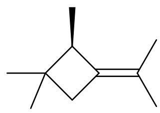
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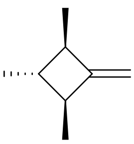
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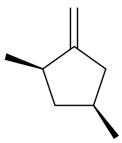
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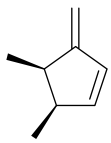
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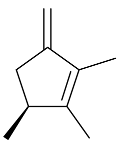
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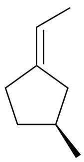
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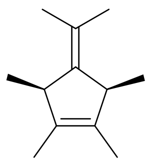
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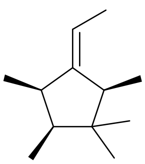
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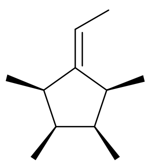
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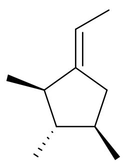
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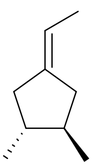
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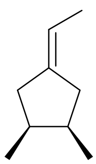
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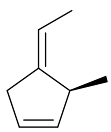
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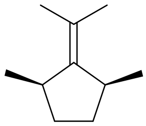
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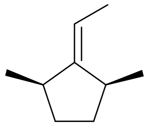
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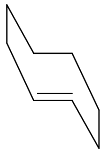
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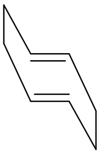
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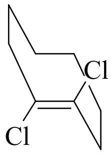
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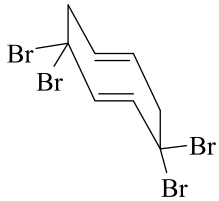
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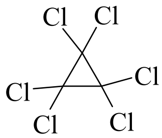
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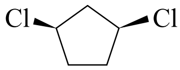
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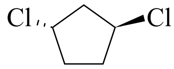
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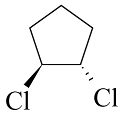
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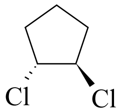
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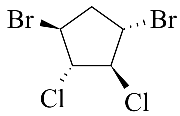
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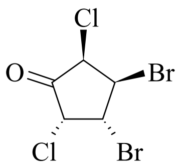
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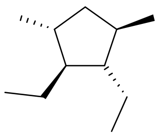
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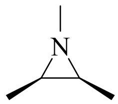
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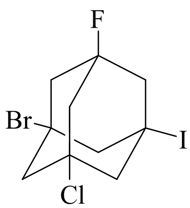
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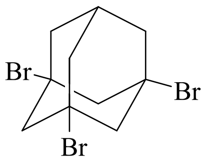
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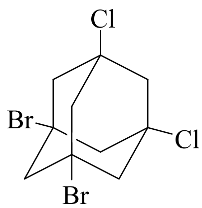
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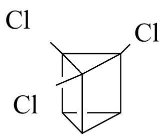
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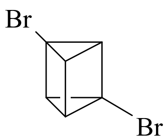
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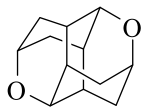
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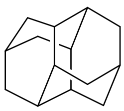
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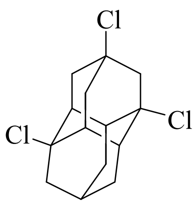
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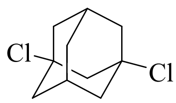
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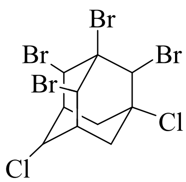
73. 

74. 

75. 

76. 

77. 

78. 

SOLUTION FOR WORKBOOK EXERCISES

EXERCISE 1

Molecules that show Geometrical Isomerism

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EXERCISE 2

Molecules that show Geometrical Isomerism

6, 9, 11, 12, 13, 14, 17, 18, 19, 20, 21, 22, 23, 25, 26, 28, 29, 30, 31, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 59, 61, 62, 63, 67, 68, 69, 70, 73, 78, 79, 83, 77, 86, 87, 90, 92, 93, 94, 95, 97, 98, 99, 100, 101, 102, 103, 106, 107, 109, 110, 111, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134.

EXERCISE 3

Molecules that show Geometrical Isomerism

1, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 25, 27, 28, 29, 30, 31, 32, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 45, 46.

Stable Conformer

47(I), 48(I), 49(I), 50(II), 51(II), 52(I = II), 53(I), 54(I), 55(II), 56(I).

EXERCISE 4

Isomeric Relationship between pair of compounds

1. Positional Isomers
2. Positional Isomers
3. Functional Isomers
4. Functional Isomers
5. Metamers Isomers
6. Chain Isomers
7. Chain Isomers
8. Chain Isomers
9. Chain Isomers
10. Functional Isomers
11. Functional Isomers
12. Not Isomers
13. Positional Isomers
14. Metamers Isomers
15. Chain Isomers
16. Metamers Isomers
17. Chain Isomers
18. Functional Isomers
19. Chain Isomers
20. Positional Isomers
21. Functional Isomers
22. Functional Isomers
23. Positional Isomers
24. Positional Isomers
25. Chain Isomers
26. Metamers Isomers
27. Functional Isomers

EXERCISE 5

Optically active compounds

4, 7, 8, 10, 12, 14, 15, 22, 23, 24, 25, 27, 28, 30, 34, 36, 37, 38, 39, 41, 43, 44, 45, 46, 48, 49, 50, 51, 52, 53, 55, 56, 58, 59, 62, 63, 64, 65, 66, 67, 69, 73.

CHAPTER 3

Hydrocarbons

Question Bank

LEVEL 1

1. When the trans-2-pentene is treated with Br_2 in the presence of CCl_4, then the number of stereoisomers formed is

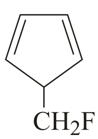
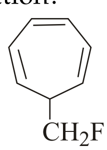
(a) 1 (b) 2 (c) 3 (d) 4

2. Which one of the following compounds will give Saytzeff product in $\mathbf{E_2}$ reaction?

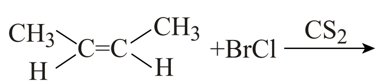
(a) $CH_3–CH_2–CH(Br)–CH_3$ (b) $CH_3–CH_2–CH(F)–CH_3$

(c) $CH_3 – CH_2 – CH_2 – \overset{\oplus}{N}(CH_3)_3 \overset{\ominus}{O}H$ (d) $CH_3–CH_2–CH(OCOCH_3)–CH_3$

3. Which compound is most reactive for $\mathbf{E_{1CB}}$ reaction?

(a) $CH_3–CH_2F$ (b)  (c)  (d) $C_6H_5–CH_2–CH_2F$

4. In the given reaction

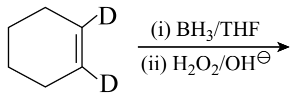


The correct option about the product is

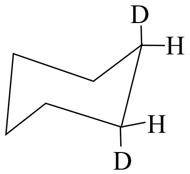
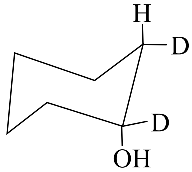
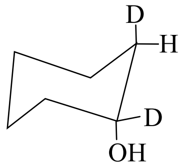
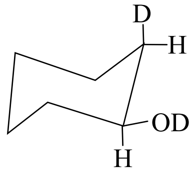
(a) (+)-2-bromo-3-chlorobutane (b) (±)-threo-2-bromo-3-chlorobutane

(c) (+)-threo-2-bromo-3-chlorobutane (d) (–)-threo-2-bromo-3-chlorobutane

5. In the given reaction



the product is

(a)  (b)  (c)  (d) 

6. o-xylene on ozonolysis may give

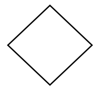
(a) CHO–CHO and $CH_3-\overset{O}{\overset{\|}{C}}-CHO_3$

(b) $CH_3-C=O$ | $CH_3-C=O$ and $CH_3-\overset{O}{\overset{\|}{C}}-CHO$

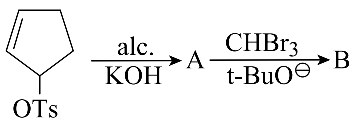
(c) $CH_3-C=O$ | $CH_3-C=O$ and CHO–CHO

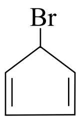
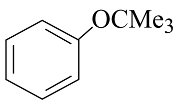
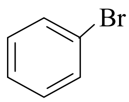
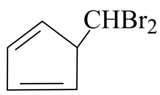
(d) $CH_3-C=O$ | $CH_3-C=O$, $CH_3-\overset{O}{\overset{\|}{C}}-CHO$ and CHO–CHO

7. A hydrocarbon (C_4H_8) on reaction with m-chloro perbenzoic acid (MCPBA) gives (X). (X) on reaction with KOH (aq.) gives (Y), which on treatment with conc. H_2SO_4 forms 2-methyl propanal. The hydrocarbon is

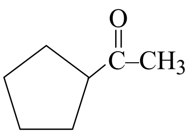
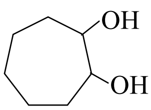
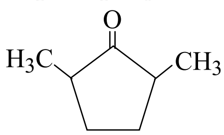
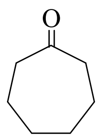
(a) $CH_2=C(CH_3)-CH_3$ (b) $CH_3-CH=CH-CH_3$ (c) $CH_3CH_2CH=CH_2$ (d) 

8. The final product of the following sequence is



(a)  (b)  (c)  (d) 

9. Major product of reaction between cycloheptyne and H_2O, $H_2SO_4/HgSO_4$ is

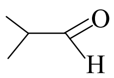
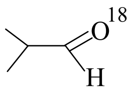
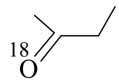
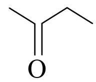
(a)  (b)  (c)  (d) 

10. $H_2C=CH-C(CH_3)_2-COOH \xrightarrow[CaO/\Delta]{NaOH}$ X; X will be

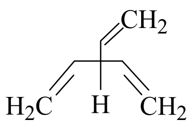
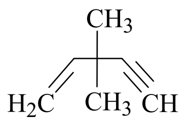
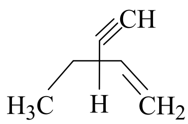
(a) $H_3C-CH=C(CH_3)-CH_3$ (b) $H_2C=CH-C(CH_3)(H)-CH_3$

(c) $H_3C{-}CH{=}\underset{}{\overset{CH_3}{\overset{|}{C}}}{-}CH_2OH$ (d) $H_2C{=}CH{-}\overset{CH_3}{\underset{CH_3}{C}}{-}COONa$

11. $CH_3{-}\overset{CH_3}{C}{=}CH_2 \xrightarrow[CH_2Cl_2]{MCPBA} [X] \xrightarrow[(ii)\ H_2O^{18}]{(i)\ H^{\oplus}} [Y] \xrightarrow{Conc.\ H^{\oplus}} [Z]$; The major product (Z) can be

(a)  (b)  (c)  (d) 

12. An optically active organic compound has the molecular formula C_7H_{10} (A). On reaction with H_2 + Pt it forms an optically inactive compound (B). Then, compound (A) will be

(a)  (b)  (c)  (d) None of these

13. Identify end products A, B and C of the following

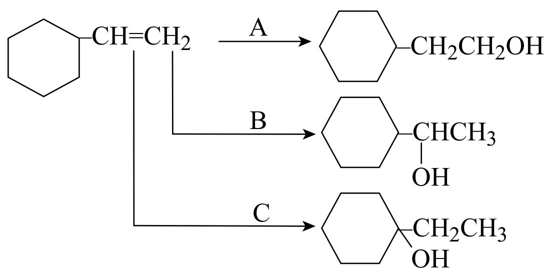
$$CH_3CH{=}CH_2 \xrightarrow[(ii)\ H_2O]{(i)\ D^{\oplus}} A$$

$$CH_3CH{=}CH_2 \xrightarrow[(ii)\ D_2O]{(i)\ H^{\oplus}} B$$

$$CH_3CH{=}CH_2 \xrightarrow[(ii)\ D_2O]{(i)\ D^{\oplus}} C$$

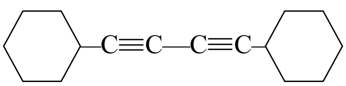
(a) $CH_3\underset{OH}{CH}CH_3$ in all case (b) $CH_3CH(OH)CH_2D$, $CH_3CH(OD)CH_3$, $CH_3CH(OD)CH_2D$

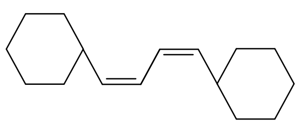
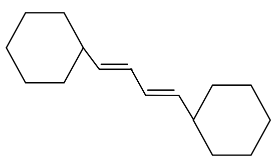
(c) $CH_3\underset{OD}{CH}CH_3$ in all cases (d) $CH_3\underset{OD}{CH}CH_2D$ in all cases

14. 

Schemes A, B and C are

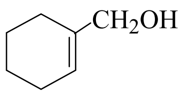
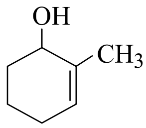
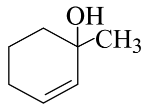
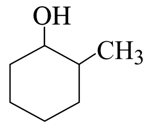
(a) simple acid catalysed hydration
(b) hydroboronation, mercuration-demercuration, acid-catalysed hydration
(c) acid-catalysed hydration, hydroboronation, mercuration-demercuration
(d) mercuration-demercuration, acid-catalysed hydration, hydroboronation

15.  $\xrightarrow{Li/NH_3}$ A; A is

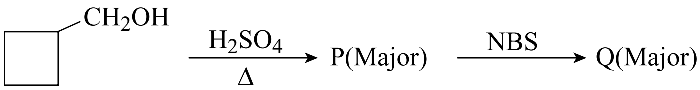
(a)  (b) 

(c) both are correct (d) none is correct

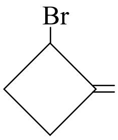
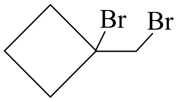
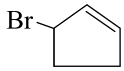
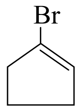
16. Rate of dehydration when given compounds are treated with conc. H_2SO_4 is

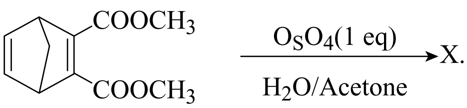
(P)  (Q)  (R)  (S) 

(a) P > Q > R > S (b) Q > P > R > S (c) R > Q > P > S (d) R > Q > S > P

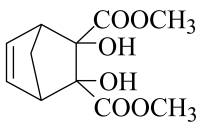
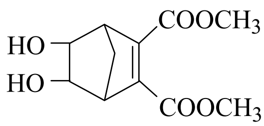
17. 

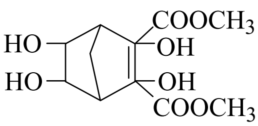
The structure of Q is

(a)  (b)  (c)  (d) 

18. 

Identify "X":

(a)  (b) 

(c)  (d) reaction will not occur

19. 1-Penten-4-yne reacts with bromine at –80°C to produce

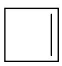
(a) 4, 4, 5, 5-Tetrabromopentene (b) 1, 2-Dibromo-1, 4-pentadiene

(c) 1, 1, 2, 2, 4, 5-hexabromopentane (d) 4, 5-dibromopentyne

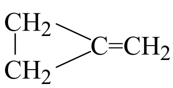
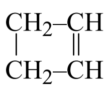
20. Which of the following reagents cannot be used to locate the position of triple bond in CH_3–C≡C–CH_3?

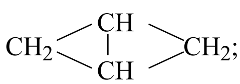
(a) Br_2 (b) O_3 (c) Cu_2^{2+} (d) $KMnO_4$

21. An organic compound of molecular formula C_4H_6, (A) forms a precipitate with ammonical silver nitrate and ammonical cuprous chloride. "A" has an isomer "B", one mole of which reacts with 1 mole of Br_2 to form 1, 4-dibromo-2-butene. Another isomer of A is "C", one mole of C reacts with only 1 mole of Br_2 to give vicinal dibromide. A, B and C are

(a) CH_3–CH_2–C≡CH and CH_2=CH–CH=CH_2; 

(b) CH_3–C≡C–CH_3 and CH_3–CH=C=CH_2; CH_3–C≡C–CH_3

(c)  and  ; CH_2=CH–CH=CH_2

(d) CH_3–C–C≡CH_3 and  ; CH_2=CH–CH=CH_2

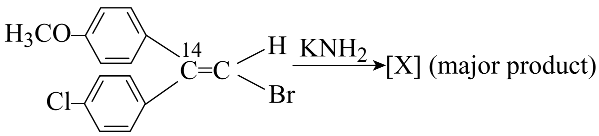
22. $CH_3-\underset{}{\overset{CH_3}{\overset{|}{C}H}}-CH_2-\underset{\underset{CH_3}{|}}{N}-CH_2-CH_2-CH_3 \xrightarrow[\text{Moist } Ag_2O,\ \Delta]{\text{Excess } CH_3I}$

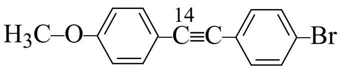
Product mixture $\xrightarrow{O_3/Zn\text{-}H_2O}$ Final product mixture

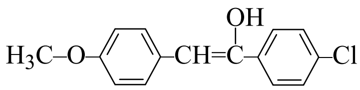
The final product mixture contains:

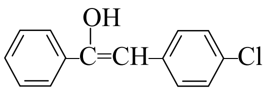
(a) $CH_3CHO + CH_3COCH_3$
(b) $CH_3CHO + CH_3CH_2CH_3 + HCHO$
(c) $CH_3CHO + HCHO$
(d) $CH_3CHO + CH_3COCH_3 + HCHO$

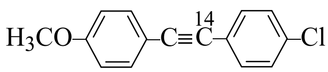
23. Choose the correct major product



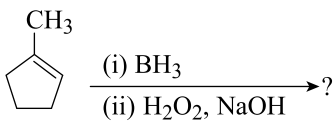
(a) 

(b) 

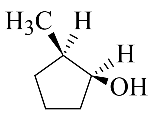
(c) 

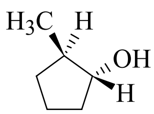
(d) 

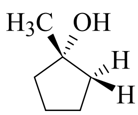
24. Supposed you carried out the hydroboration of 1-methylcyclopentene:

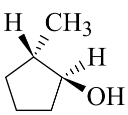


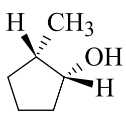
Choose the correct answer for the products formed in the above reaction.

(i) 

(ii) 

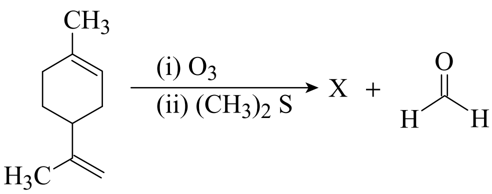
(iii) 

(iv) 

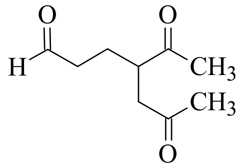
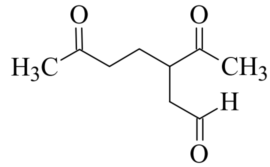
(v) 

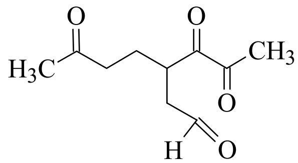
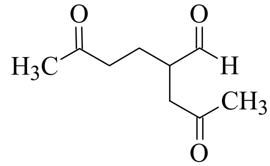
(a) An equal mixture of 1 and 5
(b) An equal mixture of 1 and 2
(c) An equal mixture of 2 and 4
(d) An equal mixture of 4 and 5

25. The ozonolysis of limonene (oil of lemons) give compound X plus formaldehyde. Choose the correct structure for X.

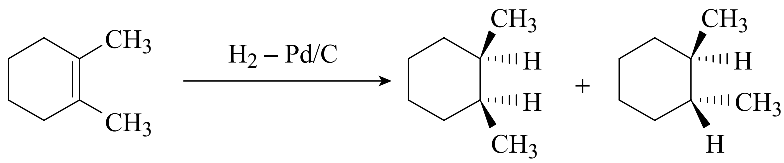


Limonene

(a)    (b) 

(c)    (d) 

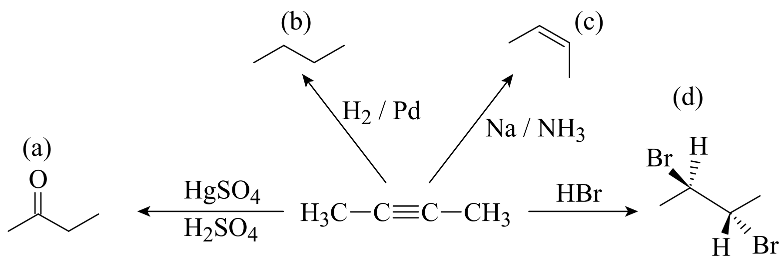
26. Choose the incorrect statement about the following catalytic hydrogenation.



major   minor

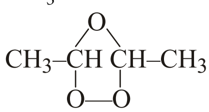
(a) The minor product occurs as the result of a catalyzed isomerization of the reactant.
(b) The minor trans isomer is actually present as a racemic mixture.
(c) The syn addition of hydrogen gives the cis isomer as the major product.
(d) The catalyst (Pd/C) speeds up the reaction by stabilizing the major product of the reaction.

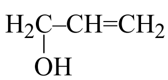
27. Choose the incorrect reaction.



28. Product of the reaction $CH_3-CH=CH-CH_3 \xrightarrow[-78°C]{O_3/CH_2Cl_2}$ will be

(a) CH_3–CHO   (b) CH_3–COOH

(c) CH_3–CH(OH)–CH(OH)–CH_3 (d) 

29.  $\xrightarrow[\text{(ii) NaSO}_3\text{H}]{\text{(i) OsO}_4}$ (A) $\xrightarrow{KHSO_4}$ (B); compound (B) is

(a) H_2C=CH–CH_2–OH   (b) H_2C=CH–COOH
(c) H_2C=CH–CHO   (d) H_2C=C=CH_2

30. CH_3–CH_2–CH_2–CH_3 $\xrightarrow[600°C]{CrO_3/Al_2O_3}$ [P]; Product is

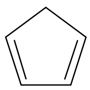
(a) Mixture of 1-butene and 2-butene (b) Cyclobutene
(c) 1,3-cyclobutadiene (d) None of these

31. In the presence of peroxide, HCl and HI do not give Anti-Markovnikov's additon to alkenes because
(a) All the steps are endothermic in both the cases
(b) One is oxidising and other is reducing
(c) One of the steps is endothermic in both the cases
(d) All the steps are exothermic in both the cases

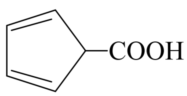
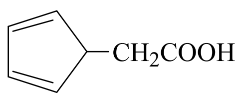
32. Hydrogenolysis is a process of
(a) Addition of H_2 across C—C multiple bond
(b) Elimination of H_2 in CH–CH bonds
(c) Cleavage of a single bond by H_2
(d) Cleavage of C—C multiple bonds by H_2

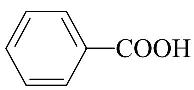
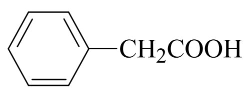
33. In the reaction with Tollen's reagent actylene shows
(a) Oxidising property (b) Reducing property
(c) Basic property (d) Acidic property

34. Arrange the following halogenating agents in order of decreasing selectivity in free radical reactions
(i) NBS (ii) NCS (iii) Cl_2 (iv) F_2
(a) iv > iii > ii > i (b) i > ii > iii > iv (c) ii > i > iii > iv (d) i > ii > iv > iii

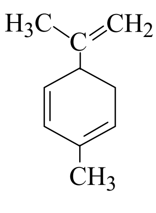
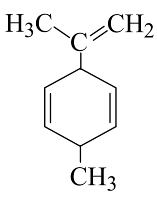
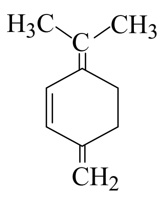
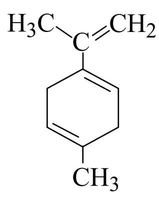
35.  + $CHBr_3$ + t-Bu$\overset{\oplus\ominus}{OK}$ $\longrightarrow$ P_1 $\xrightarrow[\text{dry ether}]{\text{Mg}}$ P_2 $\xrightarrow[\text{(ii) } H_3O^+]{\text{(i) Cl–CN}}$ P_3

The product P_3 is

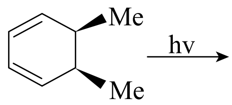
(a)  (b) 

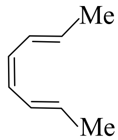
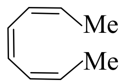
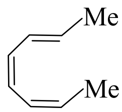
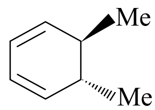
(c)  (d) 

36. A compound having the molecular formula $C_{10}H_{14}$ is hydrogenated with H_2/Pd to give 1-isopropyl-4-methyl cyclohexane and on reductive ozonolysis it gives H–C(=O)–H, CH_3–C(=O)–C(=O)–CH_2–C(=O)–H and CH_3–C(=O)–CH_2–C(=O)–H
The structure of the compound would be

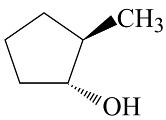
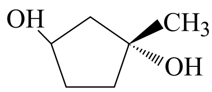
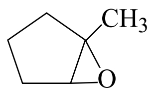
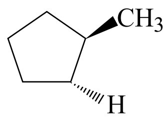
(a)  (b)  (c)  (d) 

37. The product obtained during the following photochemical reaction is



(a)  (b)  (c)  (d) 

38. The major product formed on hydroboration oxidation of 1-methylcyclopentene is

(a)  (b)  (c)  (d) 

39. Compound (A) on bromination gives (B), which gives (C) with alcoholic KOH. (C) decolouries 1% alkaline $KMnO_4$ solution and on ozonolysis, it gives two molecules of smallest carbonyl compound. Compound (A) will be

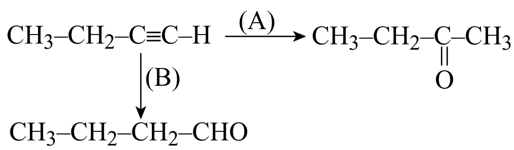
(a) C_2H_2 (b) C_2H_4 (c) C_2H_6 (d) C_2H_5Cl

40. CH_2=CH–C≡CH on reaction with 1 mole of DBr gives

(a) CH_2=CH–CBr=CHD (b) CH_2(Br)–CHDC≡CH

(c) DCH_2–CHBrC≡CH (d) CH_2=CH–CD=CHBr

41. In the given reaction, A and B respectively are



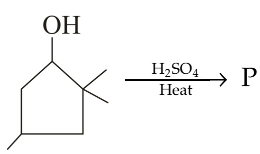
(a) $(Sia)_2BH/H_2O_2/HO^-$ and $H_2O/HgSO_4/H^{\oplus}$

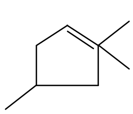
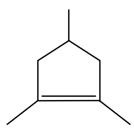
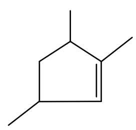
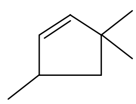
(b) $H_2O/HgSO_4/H^{\oplus}$ and $(Sia)_2BH/H_2O_2/HO^-$

(c) $H_2O/HgSO_4/H^{\oplus}$ and Na, CH_3–I

(d) None

42. Identify the major product P obtained by the reaction

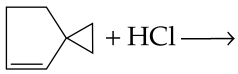


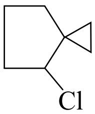
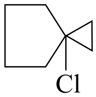
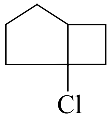
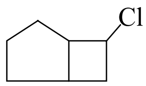
(a)  (b)  (c)  (d) 

43. During the preparation of ethane by Kolb's electrolytic method using inert electrode the pH of the electrolyte

(a) Decreases progressively as the reaction proceeds
(b) Increases progressively as the reaction proceeds
(c) Remains constant throughout the reaction
(d) May decrease if concentration of the electrolytes is not very high

44. Major product obtained by the following reaction is

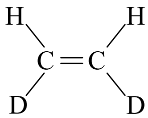
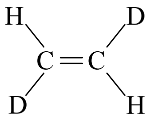


(a)  (b)  (c)  (d) 

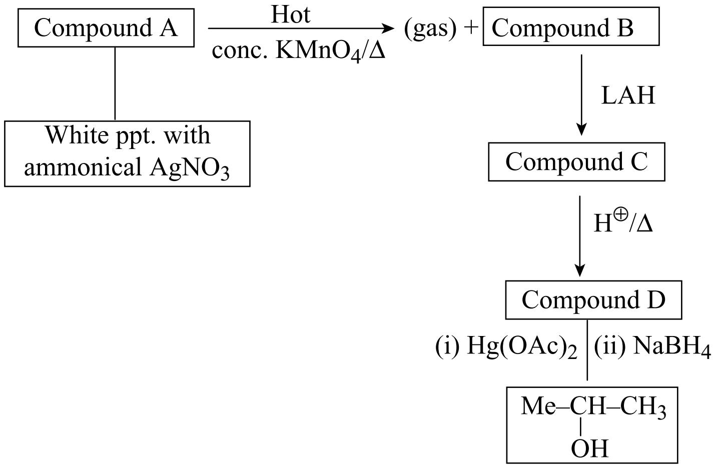
45. In the reaction

$$CH\equiv CH \xrightarrow[\text{(excess)}]{Na/NH_3\,(l)} A \xrightarrow{DCl} B \xrightarrow[\text{(ii) } CH_3COOH]{\text{(I) } Sia_2BH} (C)$$

the product (C) is

(a) $D-C\equiv C-D$ (b) $CH_3-\overset{O}{\overset{\|}{C}}-H$ (c)  (d) 

46. Identify structure of compound [A]

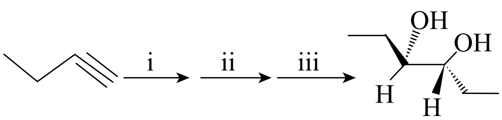


(a) Me–C≡C–Me
(b) $Me-CH_2-C\equiv CH$
(c) Me–CH=CH–Me
(d) $Me-CH_2-CH=CH_2$

47. The reaction of propene with HBr in the presence of ROOR (peroxide) proceeds through which of the following most stable intermediates?

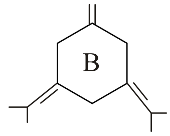
(a) $CH_3-\dot{C}H-CH_3$
(b) $CH_3-\dot{C}H-CH_2Br$
(c) $CH_3-\underset{}{\overset{Br}{\overset{|}{C}}}H-\dot{C}H_2$
(d) $CH_3-CH_2-\dot{C}H_2$

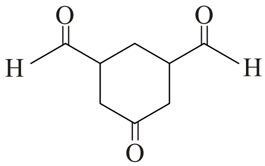
48. The following transformation is carried out in three steps. What is the appropriate reagent for the first step?

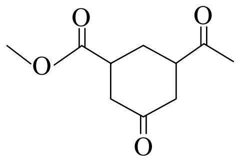


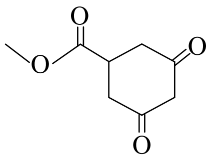
(a) H_2/Lindlar's catalyst
(b) C_2H_2/$NaNH_2$/CH_3I
(c) $NaNH_2$/NH_3: EtBr
(d) H_2/Pd/C

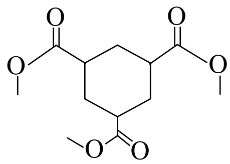
49. Compound A was treated with a large excess of CH_3MgBr. The resulting product was exposed to $POCl_3$/pyridine to give compound B, as one of many products. Which of the following compound can be A?



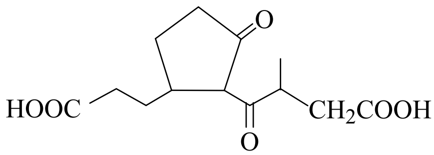
(a) 

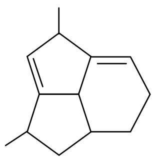
(b) 

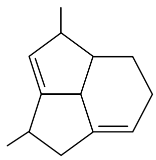
(c) 

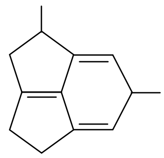
(d) 

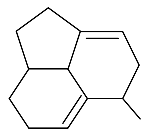
50. Which molecule will give the following dicarboxylic acid upon treatment with acidic solution of $KMnO_4/\Delta$?



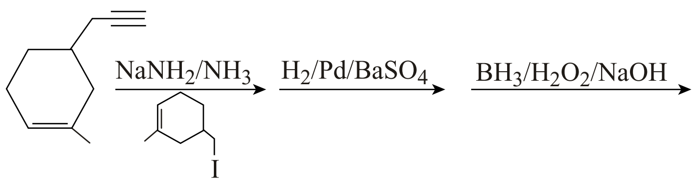
(a) 

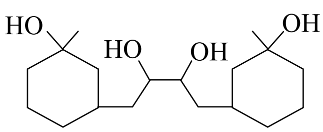
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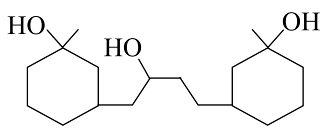
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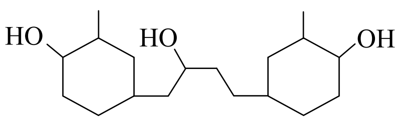
(d) 

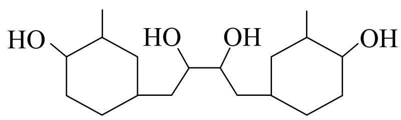
51. What is the product of the following sequence of reaction?



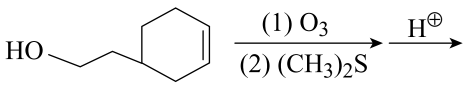
(a) 

(b) 

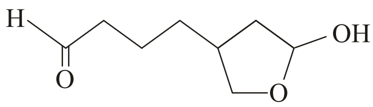
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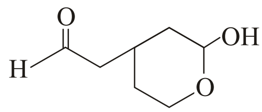
(d) 

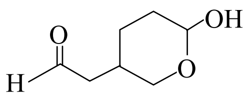
52. Give the major product of the following sequence

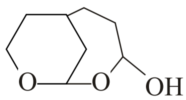


(Major product)

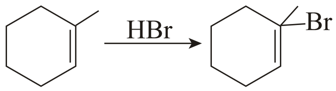
(a) 

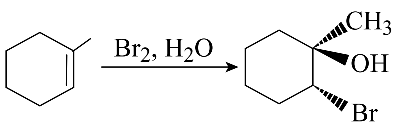
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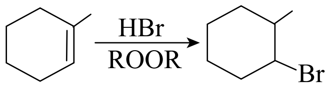
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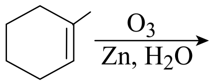
(d) 

53. Which of the following reactions involve a radical mechanism?

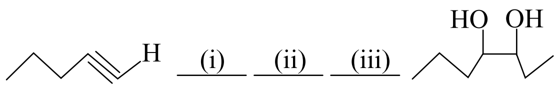
(a) 

(b) 

(c) 

(d) 

54. For the following multistep reaction, which set of reagents would be more likely to give the desired product in good yield?



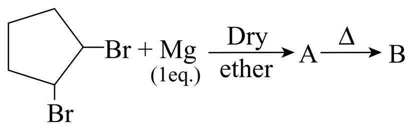
(a) (i) HBr, (ii) $O_3/Zn–H_2O$, (iii) Li/NH_3

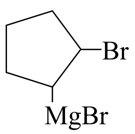
(b) (i) $NaNH_2/NH_3/C_2H_5I$, (ii) Lindlar's catalyst/H_2 (iii) OsO_4 followed by $NaHSO_3$

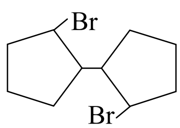
(c) (i) H_2/Pd-C, (ii) $NaNH_2/NH_3$ followed by C_2H_5I, (iii) $KMnO_4/OH^-$

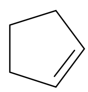
(d) (i) $HgSO_4/H_2SO_4$, (ii) Lindlar's catalyst/H_2, (iii) OsO_4 followed by $NaHSO_3$

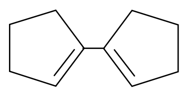
55. In the following reaction, compound (B) is



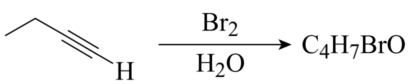
(a) 

(b) 

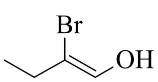
(c) 

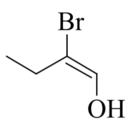
(d) 

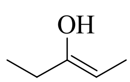
56. Here is a reaction

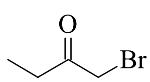


Use your knowledge of mechanisms to choose the most likely product from among the following compounds.

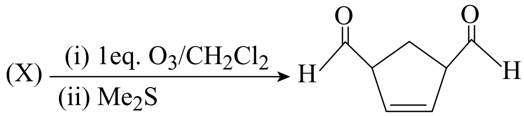
(a) 

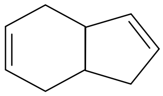
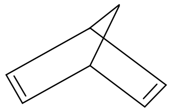
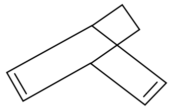
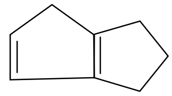
(b) 

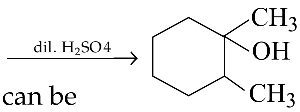
(c) 

(d) 

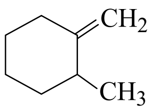
57. Identify the reactant (X) on the given reaction

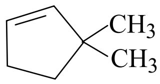


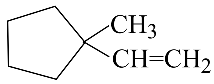
(a)  (b)  (c)  (d) 

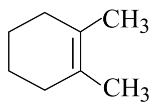
58. Compound (A) 

Compound (A) can be

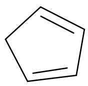
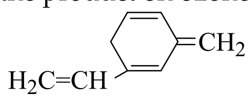
(a) 

(b) 

(c) 

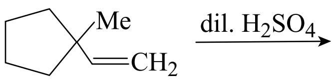
(d) 

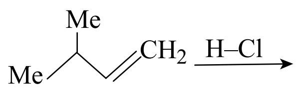
59. Which of the following gives glyoxal as one of the product on ozonolysis?

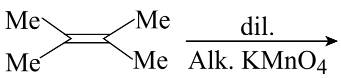
(a) 
(b) 

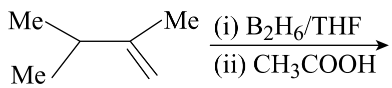
(c) $H_2C{=}CH{-}CH{=}CH_2$
(d) Benzene

60. In which of the following reaction the rearrangment of carbocation is involved?

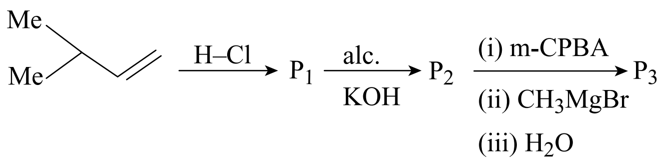
(a) 

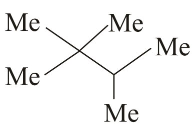
(b) 

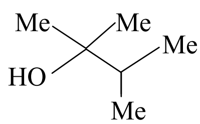
(c) 

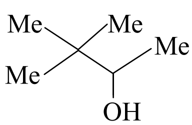
(d) 

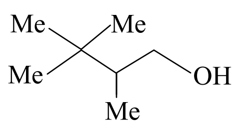
61. The final product of the given reaction is

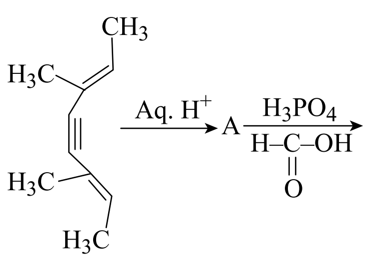


(a) 

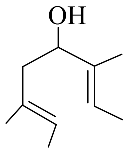
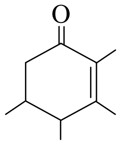
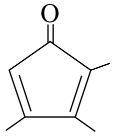
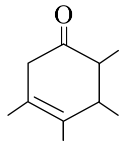
(b) 

(c) 

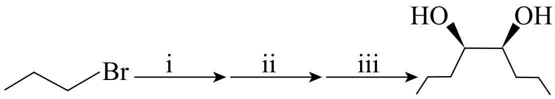
(d) 

62. 

B; Product B is

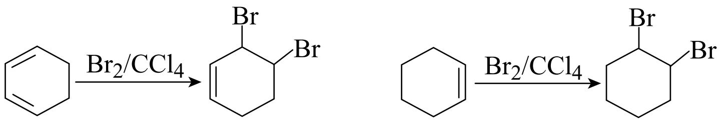
(a)  (b)  (c)  (d) 

63. Choose the best reagent to carry out the following sequence of reaction



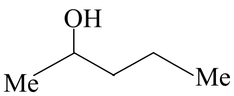
	i	**ii**	**iii**
(a)	Acetylene/$NaNH_2$/NH_3	H_2/Pd	OsO_4/$NaHSO_3$
(b)	Acetylene/$NaNH_2$/NH_3	H_2/Lindlar's catalyst	BH_3/NaOH/H_2O_2
(c)	Pentyne/$NaNH_2$/NH_3	Li/NH_3	MnO_4
(d)	Pentyne/$NaNH_2$/NH_3	H_2/Lindlar's catalyst	OsO_4/$NaHSO_3$

64. When cyclohexadiene (A) reacts with Br_2, a mixture of cis- and trans-1, 2-addition products is formed (in addition to other products). However, when cyclohexene (B) reacts with Br_2 under identical conditions, only trans product is observed. What is the best explanation for the observed difference in stereochemistry of the addition?



(A) cis and trans (B) only trans

(a) The cis and trans products are the result of aromaticity in the cyclic TS for reaction of A. In B there are only four electrons in TS, and cyclic TS is destabilised.
(b) Reaction of A proceeds through an intermediate that has an sp^3-hybridised carbocation, while the analogous intermediate in reaction of B has sp^2-hybridised carbocation.
(c) Both reactions occur through bromonium ions, but because of planarity enforced by neighbouring double bond, cis addition is not sterically hindered in A.
(d) B reacts through a bromonium ion intermediate, while A does through an allyl cation.

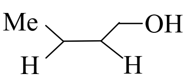
65.  $\xrightarrow[\text{Heat}]{H_2SO_4}$ number of product (x) $\xrightarrow{Br_2/CCl_4}$ number of products (y).

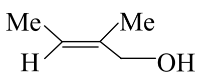
The (x) and (y) are respectively

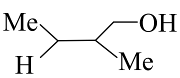
(a) ii, 4 (b) ii, 3 (c) iii, 6 (d) iii, 5

66. Final product in the given sequence is

$$\text{Me–C≡CH} \xrightarrow[-[A]\uparrow]{\text{MeMgBr}} [B] \xrightarrow[\text{II } NH_4Cl]{\text{I } H_2CO} [C] \xrightarrow[\text{Pd–BaSO}_4]{H_2} [D]$$

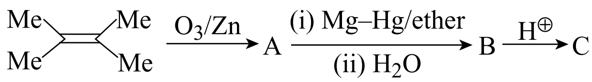
(a) 

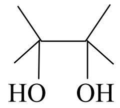
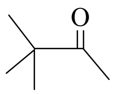
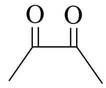
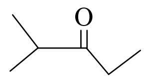
(b) 

(c) 

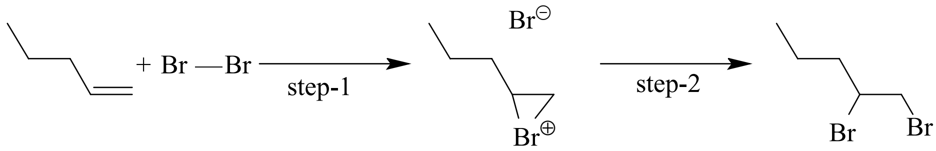
(d) None of these

67. Identify "C" product in the given reaction



(a)  (b)  (c)  (d) 

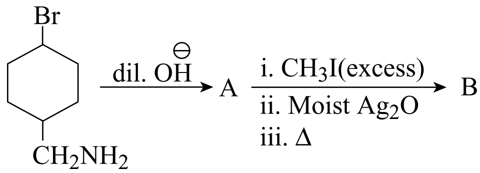
68. Consider the following reaction.

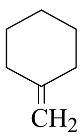
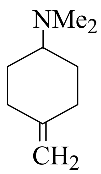
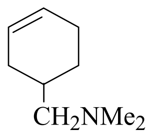
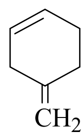


Which one of the following statements is incorrect?

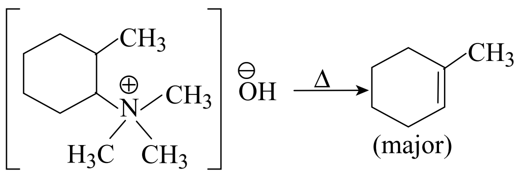
(a) The Br_2 addition occurs with anti-stereospecificity.
(b) The final product will be a mixture of enantiomers.
(c) In step 2 the Br- anion acts as a Lewis base.
(d) In step 1 the Br_2 molecule acts as a Lewis base.

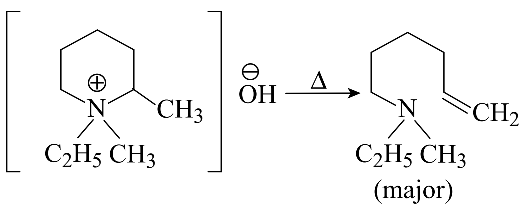
69. Identify the product in the following sequence of reaction

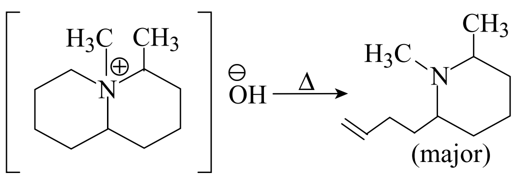


(a)  (b)  (c)  (d) 

70. Which of the following is correctly matched?

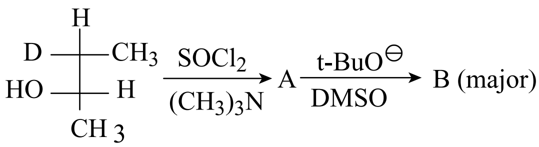
(a) 

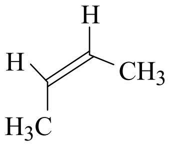
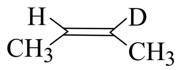
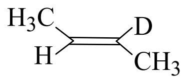
(b) 

(c) 

(d) All of these

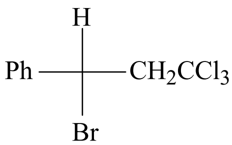
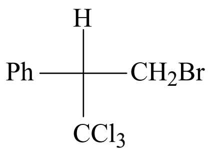
71. The final product of the given reaction sequence is

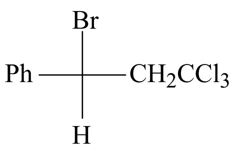
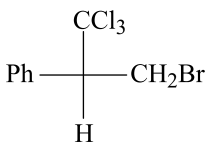


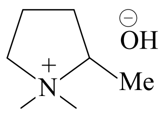
(a)  (b)  (c)  (d) none of these

72. $Ph–CH=CH_2 + BrCCl_3 \xrightarrow{\text{peroxide}}$

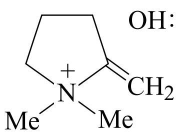
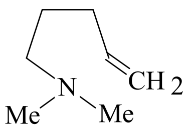
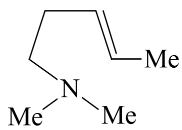
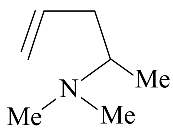
Product is

(a)  (b) 

(c)  (d) 

73. 

The above compound readily undergoes elimination on heating to yield which of the following products?

(a)  (b)  (c)  (d) 

74. Select true statement(s)

(a) Instead of radical substitution, cyclopropane undergoes electrophilic addition reactions in sun light.

(b) In general, bromination is more selective than chlorination.

(c) The 2, 4, 6-tri-tert,butylphenoxy radical is resistant to dimerisation.

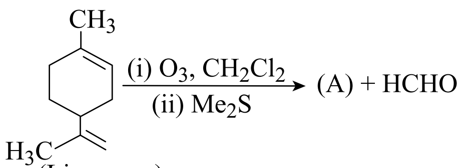
(d) The radical-catalysed chlorination, $ArCH_3 \rightarrow ArCH_2Cl$, occurs faster when Ar = phenyl than when Ar = p-nitrophenyl.

75. Which reagent is the most useful for distinguishing compound i from the rest of the compounds?

$CH_3CH_2C{\equiv}CH$	$CH_3C{\equiv}CCH_3$	$CH_3CH_2CH_2CH_3$	$CH_3CH{=}CH_2$
(i)	(ii)	(iii)	(iv)

(a) alk. $KMnO_4$ (b) Br_2/CCl_4

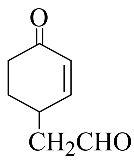
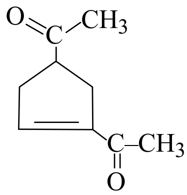
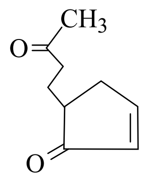
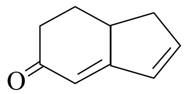
(c) Br_2/CH_3COOH (d) Ammonical $AgNO_3$

76. 

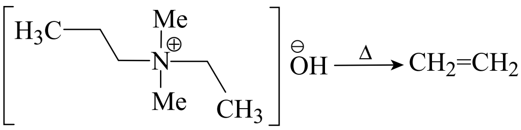
(Limonene)

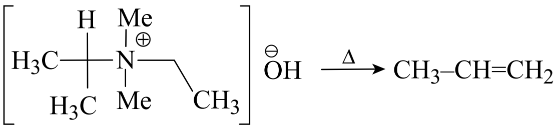
(A) $\xrightarrow[\Delta]{\text{dil. } \overset{\oplus}{\text{O}}\text{H}}$ products (mixture)

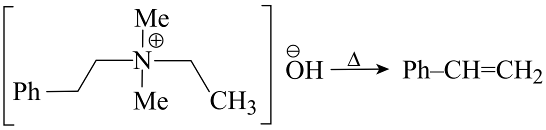
For the given reaction, the products are

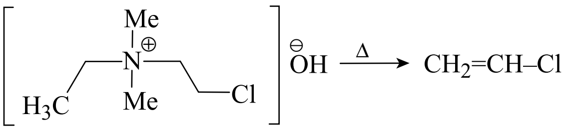
(a) 
(b) 
(c) 
(d) 

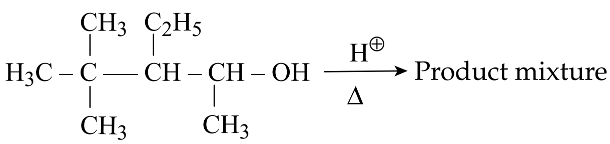
77. Which of the following reaction is correct regarding the formation of major product (alkene)?

(a) 

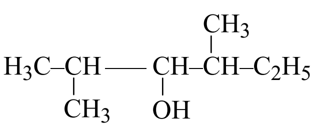
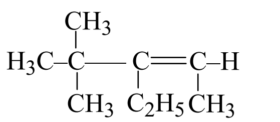
(b) 

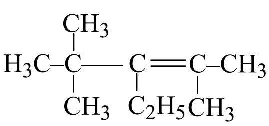
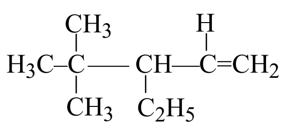
(c) 

(d) 

78. 

the product's mixture contains

(a) 
(b) 

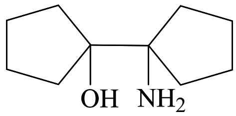
(c) 
(d) 

79. Which of the following reaction does/do not takes place by formation and rearrangement of carbocation?

(a) $R{-}CH(CH_3){-}CH{=}CH_2 \xrightarrow[\text{(ii) NaBH}_4]{\text{(i) Hg(OAc)}_2,\ H_2O}$

(b) $R{-}CH(CH_3){-}CH{=}CH_2 \xrightarrow[\text{(ii) H}_2\text{O}_2]{\text{(i) BH}_3}$

(c) $CH_3{-}C(CH_3){=}CH_2 \xrightarrow[\text{Peroxide}]{\text{HBr}}$

(d)  $\xrightarrow[\Delta]{HNO_2}$

80. Which alkyl halide will form Wittig reagent with PPh_3 and C_6H_5Li?

(a) $CH_3{-}C(CH_3)_2{-}Br$ (b) $CH_3{-}CH(CH_3){-}Br$ (c) $CH_3{-}Br$ (d) $C_6H_5{-}Br$

81. Alkyne can be converted into vic dicarbonyl compound by

(a) SeO_2 (b) Baeyer's reagent (c) $KMnO_4/H^{\oplus}$ (d) $K_2Cr_2O_7$

82. Which of these substrates will give rearranged product in hydration reaction?

(a) $CH_3{-}CH(CH_3){-}CH{=}CH_2$

(b) $CH_3-\ddot{\underset{\cdot\cdot}{S}}-CH_2-CH=CH_2$

(c) $CH_3{-}CH{=}CH_2$

(d) $Ph_2C{=}CH{-}C(CH_3)_2{-}CH_3$

83. The reagent(s) of choice for conversion of propene to methylcyclopropane is/are

(a) CH_2N_2/ether (b) CH_2I_2 (c) CH_2I_2/Zn (d) CH_3I/NaOH

84. Anti-Markonikov addition is given by which of the following alkenes?

(a) $CH_2=CH-\overset{\oplus}{N}(CH_3)_3$ (b) $CH_2{=}CH{-}CF_3$ (c) $CH_3{-}C(CH_3){=}CH_2$ (d) $C_6H_5{-}CH{=}CH_2$

85. Which of the following gives allylic substitution product?

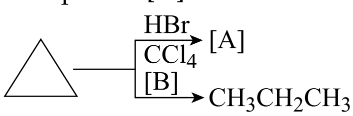
(a) $CH_2{=}CH{-}CH_3 \xrightarrow{\text{NBS/hv}}$ product

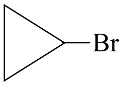
(b) $CH_2{=}CH{-}CH_3 \xrightarrow[\Delta]{SeO_2}$ product

(c) $CH_2{=}CH{-}CH_3 \xrightarrow{OsO_4}$ product

(d) $CH_2{=}CH{-}CH_3 \xrightarrow[hv]{SO_2Cl_2}$ product

86. In the given reaction, identify compound [A]



(a) Compound [A] is 

(b) Compound A is $CH_3CH_2CH_2Br$

(c) Reagent B is H_2/Ni at 120°C

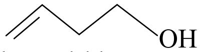
(d) Reagent B is $LiAlH_4$

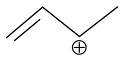
87. In which of the following Hoffman's elemination product is more?

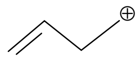
(a) $CH_3{-}C(CH_3)_2{-}CH(OH){-}CH_3 \xrightarrow{\text{conc. } H_2SO_4}$

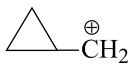
(b) $CH_3{-}C(CH_3)_2{-}CH(Br){-}CH_3 \xrightarrow[\text{t-butoxide}]{\text{Potassium}}$

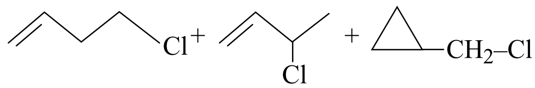
(c) $CH_3-CH_2-CH_2-CH_2-\overset{\oplus}{N}(CH_3)_3 \xrightarrow[\text{(ii) } \Delta]{\text{(i) AgOH}}$ (d) $CH_3-\underset{CH_3}{\overset{CH_3}{C}}-CH_2-Cl \xrightarrow{\text{Alc. KOH}}$

88. When  is treated with HCl then different carbocations and products formed would be

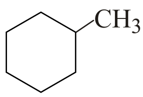
(a) 

(b) 

(c) 

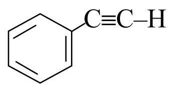
(d) 

89. Which of the following compounds can give bromination reaction with NBS/hv?

(a) $CH_3-C\equiv CH$ (b) 

(c) $CH_3-\underset{CH_3}{CH}-CH_3$ (d) $C_6H_5-CH_3$

90. Which of the following alkynes show acidic character?

(a) $H-C\equiv C-H$ (b) $CH_3-C\equiv C-H$ (c) 

(d) $CH_3-C\equiv C-CH_3$

91. Aqueous solution of which of the following compounds is electrolysed, when acetylene gas is obtained?

(a) Sodium fumerate (b) Sodium maleate

(c) Sodium acetate (d) Calcium carbide

92. Which of the following acid will give isopentane on decarboxylation with soda lime?

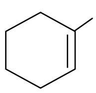
(a) $CH_3-\underset{CH_3}{\overset{COOH}{C}}-CH_2-CH_3$ (b) $CH_3-\underset{CH_3}{CH}-\overset{COOH}{CH}-CH_3$

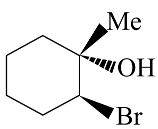
(c) $\overset{COOH}{CH_2}-\underset{CH_3}{CH}-CH_2-CH_3$ (d) $CH_3-\underset{CH_3}{CH}-CH_2-COOH$

93. Which of the following alkane cannot be synthesised by Wurtz reaction in good yield?

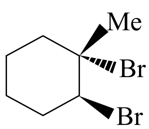
(a) $(CH_3)_2-CH-CH_2-CH-(CH_3)_2$ (b) $(CH_3)_2CH-CH_2-CH_2-CH-(CH_3)_2$

(c) $CH_3-CH_2-C(CH_3)_2-CH_2-CH_3$ (d) $CH_3-CH_2-CH_2-CH_3$

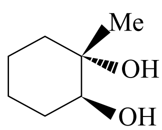
94.  $\xrightarrow{Br_2/H_2O}$ major product of the reaction is

(a) 

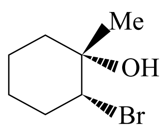
(dl)

(b) 

(dl)

(c) 

(dl)

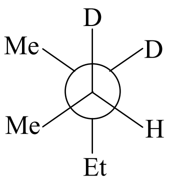
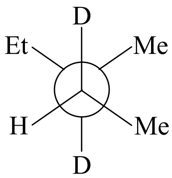
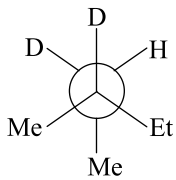
(d) 

(dl)

95. Identify per cent yield of 2°-chlorination product of 2-methyl butane (Excluding stereo-isomer), If propane on monochlorination gives 1-chloro and 2-chloro propane in 45% and 55% yield respectively and isobutane on monochlorination gives 1°-chloro and 3°-chloro product in 65% and 35% yield, respectively

(a) 40% (b) 31.28% (c) 54.3% (d) 34.28%

96. Identify major product of reaction of (E)-3-methyl-2-pentene with D_2/Ni

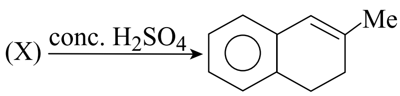
(a) 
(b) 
(c) 
(d) (a) and (c) both

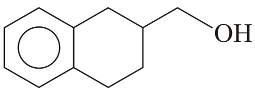
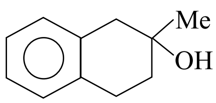
97. Test for identification of But-2-ene and benzene is

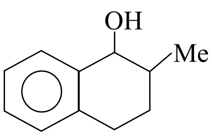
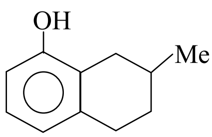
(a) Tollen's Reagent test (b) 1% Alkaline $KMnO_4$

(c) Iodoform test (d) $Br_2 + H_2O$ test

98. In the given reaction, the possible structure of compound (X) is



(a) 
(b) 

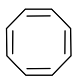
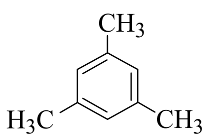
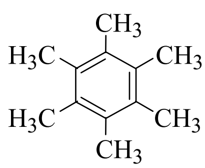
(c) 
(d) 

99. Which of the following reactions will give an alkyne?

(a) Potassium fumarate $\xrightarrow{\text{Electrolysis}}$ (b) $CH_3CBr_2CHBr_2 \xrightarrow{\text{Zn dust}}$

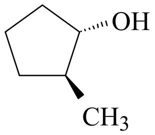
(c) $CH_3CH_2CHBr_2 \xrightarrow{\text{alc. KOH/NaNH}_2/\Delta}$ (d) $CH_3CHBrCH_2Br \xrightarrow{\text{NaNH}_2/\Delta}$

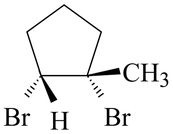
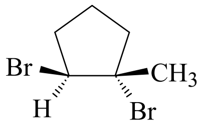
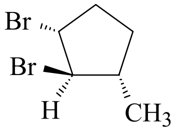
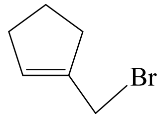
100. $4HC{\equiv}CH \xrightarrow[\text{iron tube}]{\text{red hot}}$ "X". "X" is

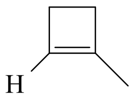
(a) Benzene (b)  (c)  (d) 

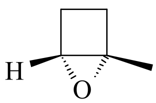
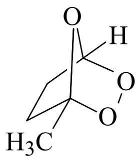
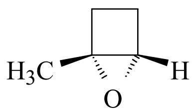
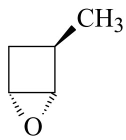
LEVEL 2

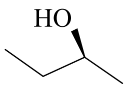
Single and Multiple-choice Type

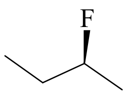
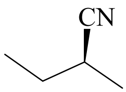
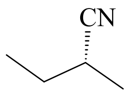
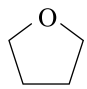
1.  $\xrightarrow[\text{2. } Br_2 / CHCl_3]{\text{1. } H_2SO_4 \text{ / heat}}$ Product

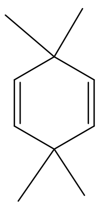
(a)  (b)  (c)  (d) 

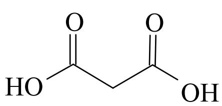
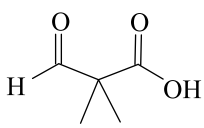
2.  $\xrightarrow{\text{MCPBA}}$ Product

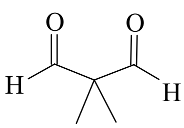
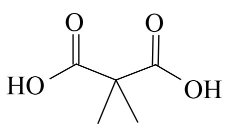
(a)  (b)  (c)  (d) 

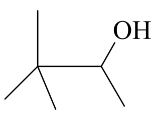
3.  $\xrightarrow[\text{2. NaCN / DMF}]{\text{1. TsCl, pyridine}}$ Product

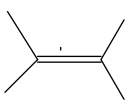
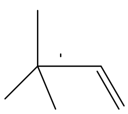
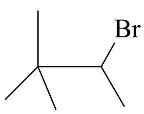
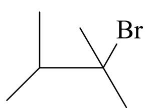
(a)  (b)  (c)  (d) 

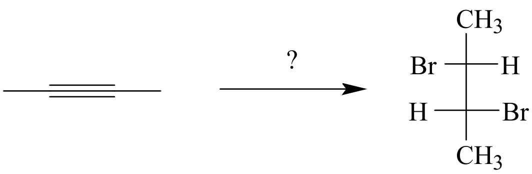
4.  $\xrightarrow[\text{2. } H_2O_2]{\text{1. Excess } O_3}$ Product

(a)  (b) 

(c)  (d) 

5.  $\xrightarrow{\text{conc. HBr}}$ Product is?

(a)  (b)  (c)  (d) 

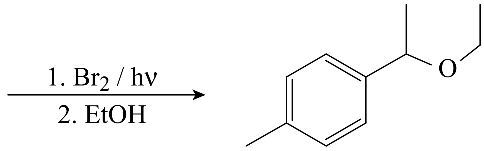
6. 

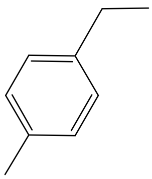
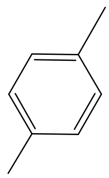
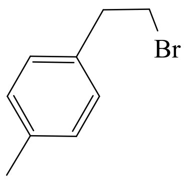
(a) (i) Na/NH_3 (l) (ii) $Br_2/CHCl_3$

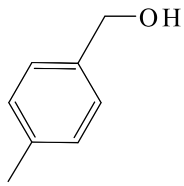
(b) (i) $H_2/Pd/CaCO_3$/pyridine (ii) HBr

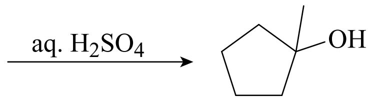
(c) (i) excess H_2/Pd (ii) Br_2, uv light

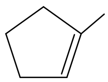
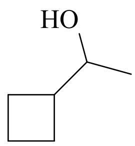
(d) (i) $H_2/Pd/CaCO_3$/pyridine (ii) $Br_2/CHCl_3$

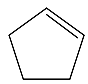
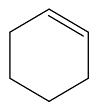
7. ? 

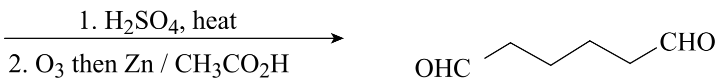
(a)  (b)  (c) 

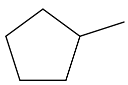
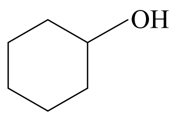
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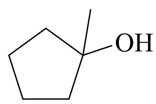
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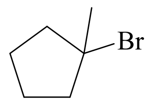
(a)  (b) 

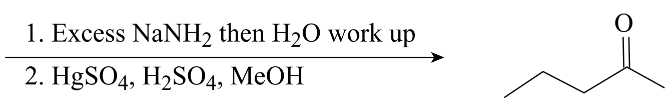
(c)  (d) 

9. ? 

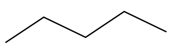
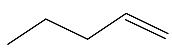
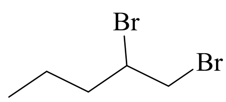
(a)  (b) 

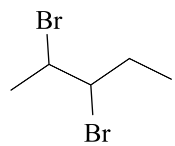
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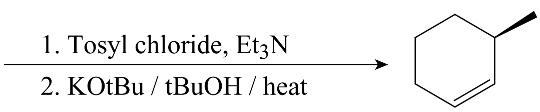
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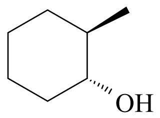
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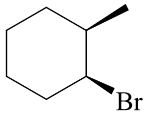
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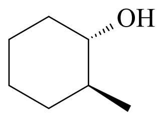
(a)  (b)  (c) 

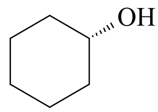
(d) 

11. ? 

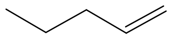
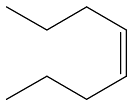
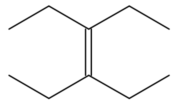
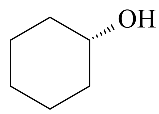
(a) 

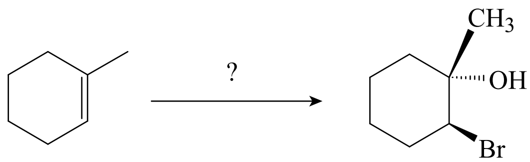
(b) 

(c) 

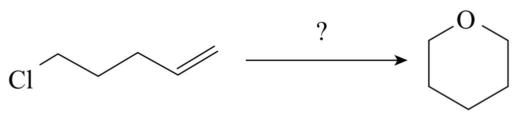
(d) 

12. ? $\xrightarrow[\text{2. } Na_2CO_3 \text{ / } CH_3I \text{ / DMF}]{\text{1. } O_3 \text{ then } H_2O}$ $CH_3CH_2CH_2CO_2CH_3$ only

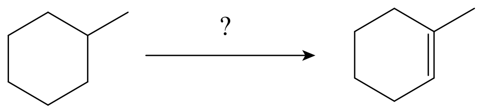
(a) 
(b) 
(c) 
(d) 

13. 

(a) (i) $Br_2/CHCl_3$ (ii) NaOH
(b) (i) NaOH (ii) NaBr
(c) (i) BH_3 then $NaOH/H_2O_2$ (ii) HBr
(d) Br_2/H_2O

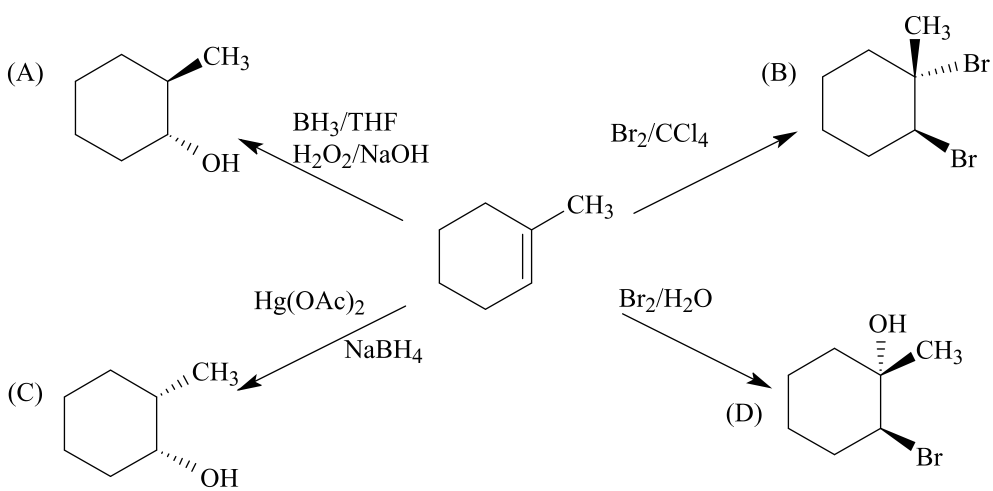
14. 

(a) (i) H_2O (ii) NaOH
(b) (i) aq. H_2SO_4 (ii) Na
(c) HBr/peroxides (ii) NaI/acetonei
(d) (i) BH_3 then $NaOH/H_2O_2$

15. 

(a) heat H_2/Pd
(b) (i) HCl (ii) KOH/EtOH/heat
(c) (i) $SOCl_2/Et_3N$ (ii) KOH/EtOH/heat
(d) (i) Br_2/hv (ii) KOH/EtOH/heat

16. Identify the correct reaction sequence



17. Which of the following is most reactive towards aqueous HBr?

(a) 1-Phenyl-2-propanol (b) 1-Phenyl-1-propanol

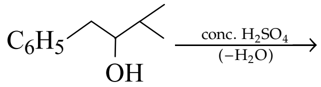
(c) 3-Phenyl-1-propanol (d) 2-Phenyl-1-propanol

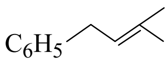
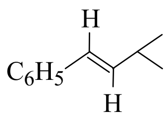
18. Ethylbenzene when treated with chlorine in the presence of light mainly gives

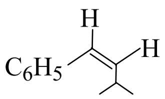
(a) β-phenylethyl chloride (b) α-phenylethyl chloride

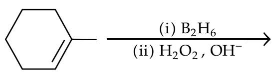
(c) o-chloroethyl benzene (d) o- and p-chloroethylbenzene

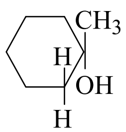
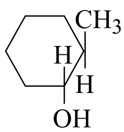
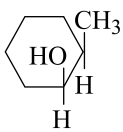
19. When the following alcohol is treated with conc. H_2SO_4, the major product obtained is



(a)  (b) 

(c)  (d) All the three will be formed in equal amounts

20.  X. The compound X is

(a)  (b)  (c)  (d) Both (b) and (c)

21. Give the nature of A and B in the given reaction

$$B \xleftarrow[H^+]{KMnO_4} (CH_3)_3COH \xrightarrow{KMnO_4/OH^-} A$$

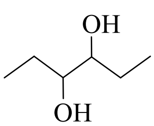
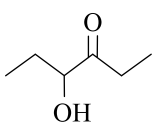
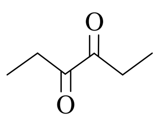
(a) A and B both are $(CH_3)_2C = CH_2$

(b) A and B both are $(CH_3)_2CO + CH_2O$

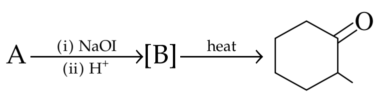
(c) A is $(CH_3)_3COH$, while B is $(CH_3)_2C = CH_2$ or $(CH_3)_2CO$

(d) A and B both are $(CH_3)_3COH$, i.e., there is no reaction

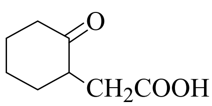
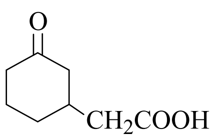
22. Which of the following is liable to be oxidised by periodic acid?

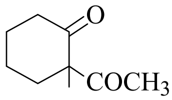
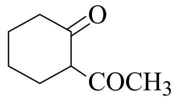
(a)  (b)  (c)  (d) All the three

23. From the given set of reaction



starting compound A corresponds to

(a)  (b) 

(c)  (d) 

24. Methanoic acid is heated with conc. H_2SO_4 to form

(a) CO (b) CO_2 (c) CH_4 (d) $(COOH)_2$

25. When ethane-1,2-dioic acid is heated with conc. H_2SO_4, it gives

(a) CO + HCOOH (b) CO_2 + HCOOH

(c) CO + CO_2 + HCOOH (d) CO + CO_2 + H_2O

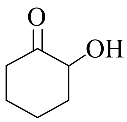
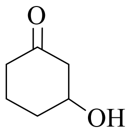
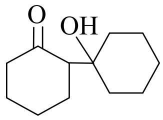
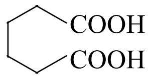
26. When sodium fumrate is heated with soda lime, we get

(a) CH_4 (b) Ethyne (c) Sodium oxalate (d) No action

27. Sodium formate is heated at 360°C to gives

(a) CO (b) CO_2 (c) Sodium oxalate (d) No action

28. When cyclohexanone is treated with Na_2CO_3 solution, we get

(a)  (b)  (c)  (d) 

29. In the given reaction, $CH_3–CH_2–C≡C–H \xrightarrow[\text{(ii) } H_2O_2/OH^-]{\text{(i) } BH_3}$ [X], [X] will be

(a) Butanal (b) Butanone (c) 2-butanol (d) 1-butanol

30. In the given reaction, $CH_3–C≡C–CH_3 \xrightarrow{H_2/Ni_2B/\Delta}$ [X], [X] will be

(a) 1-butene (b) trans-2-butene (c) cis-2-butene (d) 1-butyne

31. In the given reaction, $C_6H_5–C≡C–CH_3 \xrightarrow{Na/NH_3(l)}$ [X], [X] will be

(a) 1-phenyl propane (b) 1-phenyl propene

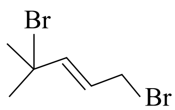
(c) trans-1-phenyl propene (d) cis-1-phenyl propene

32. In the given reaction, $CH_3–CH_2–C≡C–CH_3 + HOH \xrightarrow{HOH/\overset{\oplus}{H}/Hg^{++}}$ [X], [X] will be

(a) 2-pentanone (b) 3-pentanone

(c) Pentanol (d) Mixture of 2-pentanone and 3-pentanone

33. In the given reaction, $(CH_3)_2C=CH–CH=CH_2 + Br_2 \xrightarrow{-80°C}$ [X], [X] will be

(a) $CH_3–C(Br)(CH_3)–CHBr–CH=CH_2$ (b) 

(c) $(CH_3)_2C=C(Br)–CH=CH_2$ (d) $(CH_3)_2C=CH–CH=CH–Br$

34. In the given reaction, $CH_3–C≡CH \xrightarrow{HOBr}$ [X], [X] will be

(a) $CH_3–C(=O)–CH_2Br$ (b) $CH_3–C(=O)–CBr_2$ (c) $CH_3–C(=O)–CHBr_2$ (d) $CH_3–C(OH)=CHBr$

35. 8 mL of a gaseous hydrocarbon needs 40 mL of oxygen for its complete combustion. The hydrocarbon is

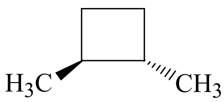
(a) CH_4 (b) C_3H_4 (c) C_3H_8 (d) C_3H_6

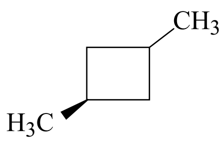
36. 0.34 g of a hydrocarbon when heated with methyl magnesium bromide gives 112 mL of CH_4 at STP. Possible structure of the hydrocarbon is

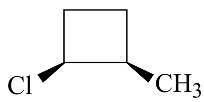
(a) $CH_3CH_2CH_2C≡CH$ (b) $CH_3CH_2C≡C–CH_3$

(c) $CH_3CH_2–CH(CH_3)–C≡CH$ (d) $CH_3CH_2CH_2CH_2C≡CH$

37. Which of the following structures are chiral?

(i) 

(ii) 

(iii) 

(a) i and iii (b) All of the three (c) i and ii (d) ii and iii

38. The lowest boiling point is expected for

(a) Isooctane (b) n-octane (c) 2,2,3, trimethyl butane (d) n-heptane

39. $CH_3–C(CH_3)(MgBr)–CH_3 + D_2O \longrightarrow$ X. "X" is

(a) $CH_3–C(CH_3)(H)–CH_3$ (b) $CH_3–C(CH_3)(D)–CH_3$ (c) $CH_3–C(CH_3)(OD)–CH_3$ (d) $CH_3–C(CH_3)(OH)–CH_3$

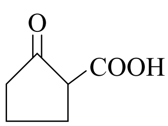
40. Acetic acid, when reacts with excess of HI in the presence of red phosphorus gives

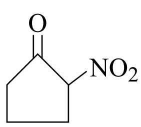
(a) Ethanol (b) Ethane (c) Acetaldehyde (d) Acetone

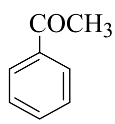
41. Sodium adipate, on electrolysis gives

(a) Cyclobutane (b) Cyclopropane (c) But-2-ene (d) But-2-yne

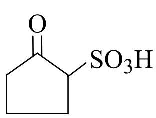
42. Clemensen reduction cannot be used in which of the following?

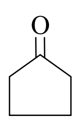
(a) 

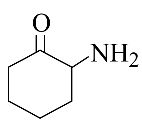
(b) 

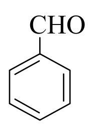
(c) $CH_3–C(=O)–H$
(d) 

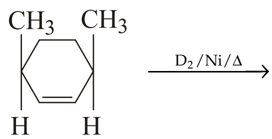
43. Wolff Kishner reduction cannot be used in which of the following?

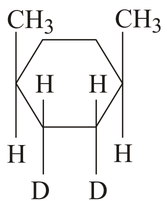
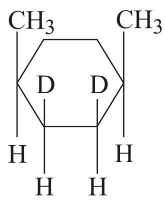
(a) 

(b) 

(c) 

(d) 

44. In the given reaction,  ?, product will be?

(a)  (b)  (c) Both (d) 70% (a) and 30% (b)

45. In the given reaction, $(CH_3)_2C{=}CH_2 \xrightarrow[\text{(ii) NaOH/H}_2\text{O}_2]{\text{(i) BH}_3}$ [X], [X] will be

(a) $(CH_3)_2COH{-}CH_3$ (b) $(CH_3)_2CH{-}CH_2OH$

(c) $(CH_3)_2C{=}CHOH$ (d) $(HOCH_2)(CH_3)C{=}CH_2$

46. In the given reaction, $CH_3{-}CH{=}CHD \xrightarrow{\text{Conc. H}_2\text{SO}_4}$ [X], [X] will be

(a) $CH_3{-}CH(OH){-}CH_2D$ (b) $CH_3{-}CH(OSO_3H){-}CH_2D$

(c) $CH_3{-}CH(OSO_3H){-}CH_3$ (d) $CH_3{-}CH(OSO_3D){-}CH_2D$

47. Arrange the following compounds in decreasing order of their heat of hydrogenation

(i) $CH_3{-}CH{=}CH_2$ (ii) $(CH_3)_2C{=}CH_2$

(iii) $(CH_3)_2C{=}CH{-}CH_3$ (iv) $CH_3{-}CH{=}CH{-}CH_3$

Select the correct answer

(a) i, iv, ii, iii (b) i, iv, iii, ii (c) iii, ii, iv, i (d) iii, ii, i, iv

48. Arrange stability of the given compounds in decreasing order

(i) $CH_2{=}C{=}CH_2$ (ii) $CH_2{=}CH{-}CH{=}CH_2$

(iii) $CH_2{=}CH{-}CH_2{-}CH_2{-}CH{=}CH_2$ (iv) C_6H_6

Select the correct anwer

(a) ii, iv, i, iii (b) iv, ii, iii, i (c) iv, ii, i, iii (d) ii, iv, iii, i

49. $2C_2H_5Cl + Zn \longrightarrow CH_3CH_2CH_2CH_3 + ZnCl_2$. The reaction is known as

(a) Frankland reaction (b) Wurtz reaction

(c) Fittig reaction (d) Wurtz-Fittig reaction

50. When isobutane is chlorinated in the presence of diffused sunlight, then the product formed is

(a) tertiary butyl chloride in major amount

(b) isobutyl chloride in major amount

(c) both 50% each

(d) n-butyl chloride, isobutyl chloride and sec-butyl chloride are formed

51. By which of the following methods, alkanes containing odd number and even number of carbon atoms can be prepared with good yield?

(a) Wurtz reaction (b) Frankland reaction

(c) Riemer Tiemann reaction (d) Groove's process

52. During the halogenation of n-pentane, assuming no regeoselectively, the ratio in which 1-chloropentane, 2-chloropentane and 3-chloropentane are formed is

(a) 1:2:3 respectively (b) 3:2:1 respectively

(c) 9:4:1 respectively (d) 1:1:2 respectively

53. When isobutane is brominated in the presence of diffused sunlight then the product formed is

(a) exclusively tertiary butyl bromide (b) exclusively isobutyl bromide

(c) exclusively n-butyl bromide (d) s-butyl bromide

54. Which of the following statements is correct?

(a) Chlorination of CD_4 is about 12 times faster than the chlorination of CH_4.

(b) Chlorination of CH_4 is about 12 times faster than the chlorination of CD_4.

(c) Chlorination of CH_4 and CD_4 takes place at the same step.

(d) C–H and C–D bond energies are the same.

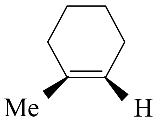
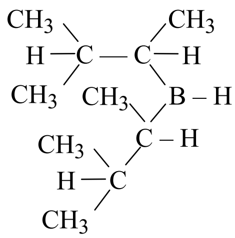
55. When 2-butyne is brominated, A is formed. When 2-butyne is reacted with $HgSO_4 + H_2SO_4$, then B is formed which then gives C. Hence

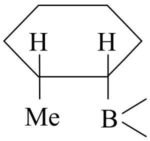
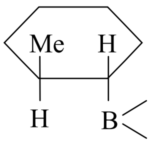
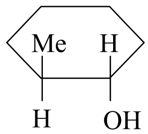
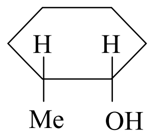
(a) A is $\begin{matrix}Me\\Br\end{matrix}\!>\!C{=}C\!<\!\begin{matrix}Me\\Br\end{matrix}$ and B is $Me{-}\overset{\overset{\displaystyle OH}{|}}{C}{=}CH{-}Me$

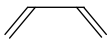
(b) A is $\begin{matrix}Me\\Br\end{matrix}\!>\!C{=}C\!<\!\begin{matrix}Br\\Me\end{matrix}$ and B is $Me{-}\overset{\overset{\displaystyle OH}{|}}{C}{=}CH{-}Me$

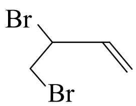
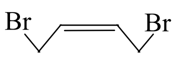
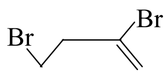
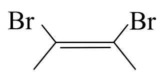
(c) B is $Me{-}\underset{\underset{\displaystyle OH}{|}}{C}{=}CH{-}Me$ and C is $Me{-}\overset{\overset{\displaystyle O}{||}}{C}{-}CH_2{-}CH_3$

(d) B is $Me{-}\overset{\overset{\displaystyle OH}{|}}{\underset{\underset{\displaystyle OH}{|}}{C}}{-}CH_2{-}Me$ and C is $Me{-}\overset{\overset{\displaystyle O}{||}}{C}{-}CH_2{-}CH_3$

56. When  is reacted with  followed by treatment with H_2O_2/OH^-, then the different products formed at different stages are

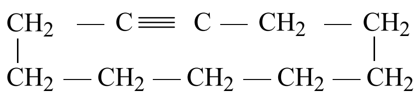
(a) 
(b) 
(c) 
(d) 

57. When  is treated with Br_2 (1-equivalent), it would give

(a) 
(b) 
(c) 
(d) 

58. $(H-C\equiv CLi + Br-(CH_2)_8-Br) \longrightarrow A \xrightarrow{CH_3Li} B \xrightarrow{A} C$

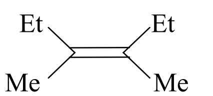
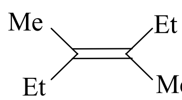
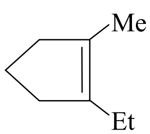
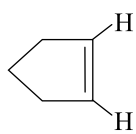
In this reaction, sequences

(a) A is $H–C\equiv C–(CH_2)_8–Br$
(b) B is $H–C\equiv C–H$ and C is $Li\ C\equiv C–(CH_2)_8–Br$
(c) B is $Li\ C\equiv C–(CH_2)_8–Br$ and C is 
(d) B is $Li\ C\equiv C–(CH)_8–Br$ and C is $Br\ (CH_2)_8\ C\equiv C\ (CH_2)_8\ Br$

59. When CH_2=CH–Br is reacted with HBr then the product formed is A and when CH_2=CH–COOH is treated with HBr then the product formed is C. Hence here

(a) A is $CH_2(Br)-CH_2(Br)$
(b) A is $CH_3-CH(Br)_2$
(c) C is $CH_3–CH(Br)–COOH$
(d) C is $CH_2(Br)-CH_2-COOH$

60. Which of the following will give cis diol?

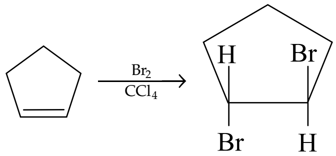
(a)  $\xrightarrow[\text{(ii) } H_2O/OH^-]{\text{(i) } KMnO_4}$
(b)  $\xrightarrow[\text{(ii) } Na_2SO_3]{\text{(i) } OsO_4}$
(c)  $\xrightarrow[Na_2SO_3]{OsO_4\ 25°C}$
(d)  $\xrightarrow[HCOOH\ 25°C]{35\%\ H_2O_2}$

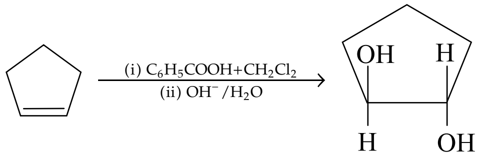
61. Which of the following reactions will give alkyne?

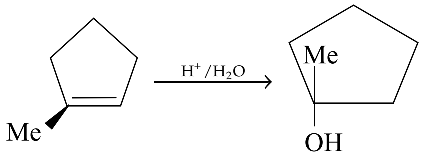
(a) $CH_3CH_2CH(Cl)–CH_2(Cl) \xrightarrow[H_2O]{NaNH_2}$
(b) $CH_3CH_2CHBr_2 \xrightarrow[\Delta]{alc.\ KOH}$

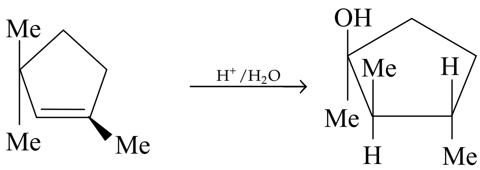
(c) $CH_3-\underset{Br}{\overset{Br}{C}}-\underset{Br}{\overset{Br}{C}}-CH_3 \xrightarrow{Zn/alcohol}$ (d) Potassium maleate $\xrightarrow{Electrolysis}$

62. Which of the following reactins are correct?

(a) 

(b) 

(c) 

(d) 

63. In the conversion given below

$$CH_3-CH_2-C\equiv CH \begin{cases} \xrightarrow{a} CH_3-CH_2-\underset{\|}{C}-CH_3 \ (C=O) \\ \xrightarrow{b} CH_3-CH_2-C\equiv CD \\ \xrightarrow{c} CH_3-CH_2-\underset{Br}{C}=\overset{Br}{C}-CH_3 \\ \xrightarrow{d} CH_3-CH_2-CH_2-\underset{\|}{C}-H \ (C=O) \end{cases}$$

(a) $H_2O/Hg^{2+}/H^+$ (b) (i) one equivalent of LDA, (ii) D_2O

(c) Br_2/CCl_4 (d) (i) $(Sia)_2BH$, (ii) H_2O_2/OH^-

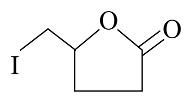
64. Which of the following reactions are correctly represented?

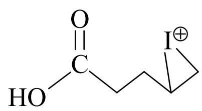
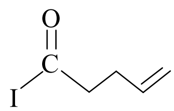
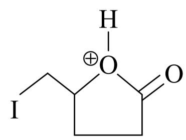
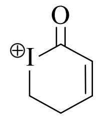
(a) $R-CH=CH_2 + HCl \longrightarrow R-\underset{Cl}{CH}-CH_3$

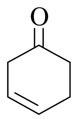
(b) $R-CH=CH_2 + HI \xrightarrow{Peroxide} R-CH_2-CH_2-I$

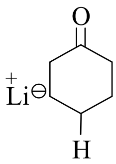
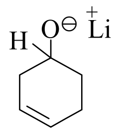
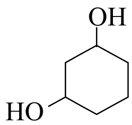
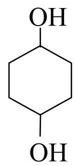
(c) $R-CH=CH_2 + HBr \xrightarrow{Peroxide} R-CH_2-CH_2-Br$

(d) $R-CH=CH_2 + HI \xrightarrow{Peroxide} R-\underset{I}{CH}-CH_3$

65. The iodo lactisation of  with I_2 gives the compound  + HI. The different intermeidates are

(a) 
(b) 
(c) 
(d) 

66.  $\xrightarrow{LiAlH_4}$ A $\xrightarrow{H^+/H_2O}$ B. Here

(a) A is 
(b) A is 
(c) B may be 
(d) B may be 

67. The reaction of propane with nitric acid in vapour phase gives

(a) 1-nitropropane
(b) 2-nitropropane
(c) Nitromethane
(d) Nitroethane

68. n-hexane reacts with Pt at 770 K to give

(a) Cyclohexane (b) Benzene (c) Isohexane (d) Neohexane

69. Iodination of methane can be carried out in the presence of

(a) HI (b) HIO_3 (c) HNO_3 (d) NaOH

70. Cracking of alkanes involves

(a) Homolytic fission
(b) Free radical
(c) Heterolytic fission
(d) Carbocation

71. Arrange reactivity of the given compounds in decreasing order for electrophilic addition reaction

(i) $C_6H_5–CH=CH_2$
(ii) $C_6H_5–C(CH_3)=CH–CH_3$
(iii) $C_6H_5–C(C_6H_5)=CH–CH_3$
(iv) $CH_2=CH–NO_2$

Select the correct answer

(a) iv, i, ii, iii (b) iii, ii, i, iv (c) ii, iii, i, iv (d) ii, iii, iv, i

72. Which among the following compounds will give electrophilic addition reaction?

(i) $CH_2=CH_2$
(ii) $CH_3–C≡CH$
(iii) $CH_2=CH–CH=CH_2$
(iv) $(NO_2)_2C=C(NO_2)_2$

Select the correct answer

(a) i, ii and iii (b) i and ii (c) i, ii and iv (d) i, ii, iii and iv

73. In which compound addition reaction will take place according to anti-Morkonikov's rule?

(i) $CH_2{=}CH{-}NO_2$ (ii) $CH_2{=}CH{-}CHO$ (iii) $CH_2{=}CH{-}CN$ (iv) $CH_3{-}CH{=}CH_2$

Select the correct anwer

(a) i, ii and iii (b) i, ii and iv (c) i and ii (d) i and iii

74. For electrophilic addition with HCl, which pair is correctly matched?

(i) $CH_3{-}CH{=}CH_2$, alkyl carbocation

(ii) $CH_3{-}CH{\equiv}CH$, vinyl carbocation

(iii) $CH_2{=}CH{-}CH{=}CH_2$, allyl carbocation

(iv) $C_6H_5{-}CH{=}C(CH_3)_2$, alkyl carbocation

Select the correct answer

(a) i, iii and iv (b) ii, iii and iv (c) i, ii and iii (d) i, ii and iv

75. Consider the following statements

(i) Alkene is more reactive than alkyne for electrophilic addition reaction.

(ii) Alkyne gives nucleophilic as well as electrophilic addition reaction.

(iii) Alkyne is more reactive than alkene for nucleophilic addition reaction.

(iv) For electrophilic addition reaction, RI of alkyne is alkyl carbocation.

Of these, the correct statements are

(a) Only i (b) i and ii (c) i, ii and iv (d) i, ii and iii

76. Consider the following statements

(i) Conjugated diene gives direct as well as conjugate addition.

(ii) Conjugated diene gives only direct addition.

(iii) Conjugated diene gives only conjugate addition.

(iv) Thermodynamically controlled product is obtained by less stable reaction intermediate.

Of these, the correct statements are

(a) Only i (b) i and iv (c) ii and iii (d) Only iii

77. Consider the following statements

(i) Conjugated diene gives i, 2 and i, 4 adduct.

(ii) Conjugated diene gives kinetically and thermodynamically controlled product.

(iii) Formation of kinetically controlled product takes place by formation of stable RI.

(iv) Formation of thermodynamically controlled product takes place by the formation of stable RI.

Of these, the correct statements are

(a) i, ii and iii (b) i, ii and iv (c) Only i (d) Only iv

78. Which among the following reagents give syn addition with alkenes?

(i) Br_2 (ii) dil. $KMnO_4/OH^-$

(iii) $OsO_4/NaSO_3H/HOH$ (iv) $H_2/Ni/\Delta$

Select the correct answer

(a) Only i (b) ii and iii (c) ii, iii and iv (d) Only iv

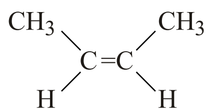
79. Match List i (reaction) with List ii (reagent) and select the correct answer from the codes given below

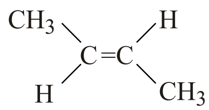
List I	List II
(a) $CH_3-CH=CH_2 \longrightarrow CH_3-CH_2-CH_2-OH$	(i) $Na/NH_3(l)$
(b) $CH_3-CH=CH_2 \longrightarrow CH_3-\overset{OH}{\overset{\vert}{C}H}-CH_3$	(ii) (i) BH_3 (ii) $H_2O_2/\overset{\ominus}{O}H$
(c) $CH_3-C\equiv C-CH_3 \longrightarrow$ trans-2-butene	(iii) Ni_2B
(d) $CH_3-C\equiv C-CH_3 \longrightarrow$ cis-2-butene	(iv) (i) Conc. H_2SO_4 (ii) HOH

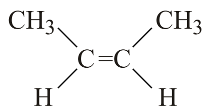
	a	b	c	d
(a)	iv	ii	i	iii
(b)	iv	ii	iii	i
(c)	ii	iv	i	iii
(d)	ii	iv	iii	i

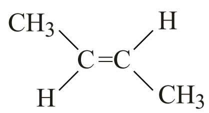
80. Match List I (substrate/reagent) with List II (product) and select the correct answer

List I — List II

(a)  + Br_2 — (i) (±) 2,3-dibromobutane

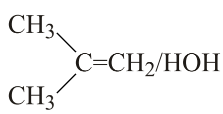
(b)  + Br_2 — (ii) (±) 2,3-butanediol

(c)  + Baeyer reagent — (iii) Meso-2,3-dibromobutane

(d)  + Baeyer reagent — (iv) Meso-2,3-butanediol

	a	b	c	d
(a)	iii	i	iv	ii
(b)	i	iii	iv	ii
(c)	i	iii	ii	iv
(d)	iii	i	ii	iv

81. Match List I (substrate/reagent) with List II (RI of the reaction) and select the correct answer

List I	List II
(a) $C_6H_5-CH=CH-CH_3/HCl$	(i) $CH_3-CH_2-\overset{\oplus}{C}H-CH=CH_2$
(b) 	(ii) $CH_3-\overset{\oplus}{C}H-CH_2-CH=CH_2$
(c) $CH_3-C\equiv CH/HCl$	(iii) $C_6H_5-\overset{\oplus}{C}H-CH_2-CH_3$

(d) $CH_3–CH=CH–CH=CH_2/HCl$

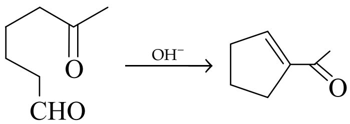
(iv) $C_6H_5–\overset{\oplus}{C}=CH_2$

(v) $(CH_3)_2\overset{\oplus}{C}–CH_3$

	a	b	c	d
(a)	iii	v	iv	i
(b)	iii	v	iv	ii
(c)	v	iii	iv	i
(d)	v	iii	i	iv

82. Which of the following reagent reacts in different ways with CH_3CHO, HCHO and C_6H_5CHO?

(a) Fehling solution (b) $C_6H_5NHNH_2$ (c) Ammonia (d) HCl

83. The reaction  is an example of

(a) Oxidation reaction
(b) Reduction
(c) Both
(d) Aldol condensation

84. $C_6H_5\underset{}{\overset{OH}{\overset{|}{C}}}H-\overset{O}{\overset{||}{C}}-C_6H_5 \xrightarrow[HCl]{Zn/Hg}$ P. Here, P should be

(a) $C_6H_5\overset{OH}{\overset{|}{C}}H\overset{OH}{\overset{|}{C}}HC_6H_5$
(b) $C_6H_5\overset{Cl}{\overset{|}{C}}HCH_2C_6H_5$
(c) $C_6H_5CH_2CH_2C_6H_5$
(d) $C_6H_5CH = CHC_6H_5$

85. Nitrobenzene can be reduced to aniline by

(i) H_2/Ni (ii) Sn/HCl (iii) Zn/NaOH (iv) $LiAlH_4$

(a) i, ii and iii (b) i and ii (c) i, ii and iv (d) only ii

86. 1-methylcyclopentene can be converted into 2-methylcyclohexanol by

(a) acid-catalysed hydration
(b) hydroboration oxidation
(c) epoxide formation followed by reduction with $LiAlH_4$
(d) oxymercuration-demercuration

87. 2-methylpropanol-2 can be obtained by the acid-catalysed hydration of

(a) $CH_3CH_2CH=CH_2$
(b) $CH_3CH=CHCH_3$
(c) $(CH_3)_2C=CHCH_3$
(d) either of the three

88. Predict the nature of P in the following reaction: $CH_3C \equiv CCH_3 \xrightarrow[heat]{NaNH_2/\text{inert solvent}} P$

(a) $CH_2=CHCH=CH_2$
(b) $CH_2=C=CH–CH_3$
(c) $CH_3CH_2C \equiv CH$
(d) No reaction

89. Arrange the following alcohols in order of increasing ease of dehydration

CH_3CH_2OH $C_6H_5CH_2OH$ Cl_3CCH_2OH F_3CCH_2OH

i ii iii iv

(a) ii < i < iv < iii (b) iv < iii < ii < i (c) iv < iii < i < ii (d) ii < i < iii < iv

90. Which of the following statements are true?

(i) Structural isomers are compounds with the same molecular formula, but are different in the connectivity (order of attachment) of their atoms.

(ii) Stereoisomers are compounds with the same molecular formula and same order of attachment of their atoms, but are different in the orientation of their atoms or groups in space.

(iii) Enantiomers are stereoisomers whose molecules are mirror images of each other.

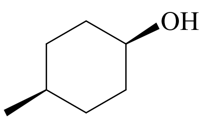
(iv) Diastereomers are stereoisomers whose molecules are not mirror images of each other.

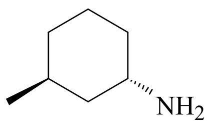
(v) A molecule with two chiral centres designated as (R,R) will have an enantiomer with two chiral centres designated as (S,R).

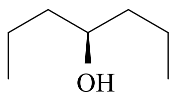
(vi) Cis-1,2-dichlorocyclopentane and trans-1,2-dichlorocyclopentane are enantiomer to each other.

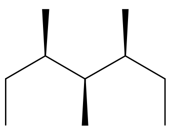
(a) i, ii, iv, vi (b) i, ii, iii, iv (c) i, ii, iii, iv, vi (d) ii, iii, iv, vi

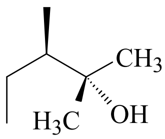
91. Which of the following are chiral molecules?

(i) 

(ii) 

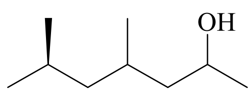
(iii) 

(iv) 

(v) 

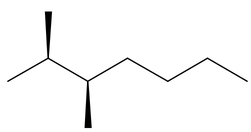
(a) ii (b) i, ii, iv (c) ii, v (d) ii, iv, v

92. How many stereoisomers are possible for the following compound?



(a) 2 (b) 3 (c) 4 (d) 8

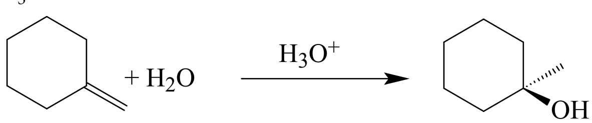
93. What is the name of the following compound?



(a) (2R,3S)-2,3-dimethylhexane (b) (R)-2,3-dimethylhexane

(c) (S)-2,3-dimethylhexane (d) (2S,3R)-2,3-dimethylhexane

94. What is the role of H_3O^+ in this reaction?



(a) Base (b) Nucleophile (c) Catalyst (d) Leaving group

95. Which statements are true for S_N2 reaction of alkyl halides?

i: Both of the alkyl halide and nucleophile are involved in the transition state.

ii: Reaction proceeds with inversion of configuration at the substitution centre.

iii: Reaction proceeds with retention of configuration at the substitution centre.

iv: The order of reactivity is $3^o > 2^o > 1^o$.

v: The nucleophile must have an unshared electron pair and bears a negative charge.

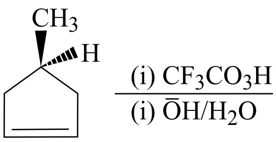
vi: The greater the nucleophilicity of the nucleophile, the greater the rate of reaction.

(a) i, ii, iv, v (b) i, ii, v, vi (c) i, iii, v, vi (d) i, ii, vi

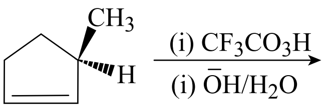
Comprehension Type

Passage 1

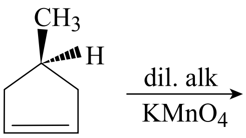
In the given reactions

(i) 

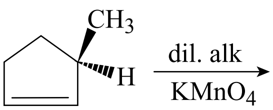
Product (X + Y)

(ii) 

Product (P + Q)

(iii) 

Product (A + B)

(iv) 

Product (M + N)

96. For the given reaction (i), X and Y are

(a) Meso compound (b) Diastereomers

(c) Identical (d) Enantiomers

97. For the given reaction (iv), products M and N are

(a) Enantiomers (b) Diastereomers (c) Identical (d) Meso compound

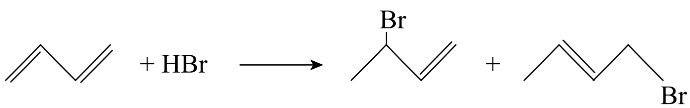
98. Which of the following is a correct statement?

(a) Products A and B are Diastereo Isomers (b) Products P and Q are enantiomers

(c) Products A and B are identical (d) Products P and Q are identical

Passage 2

The reaction of 1, 3-butadiene with HBr is shown below. At 40°C the major product is the 1, 4-addition product; however, at –80°C the major product is the 1, 2-addition product.



1, 2-addition 1, 4-addition

99. Thermodynamically controlled product is

(a) 1, 2-addition product
(b) 1, 4-addition product
(c) The products have same stability
(d) cannot be determined

100. Why are two products formed?

(a) The carbocation intermediate allows delocalisation of the second double bond.
(b) There are two double bonds present.
(c) The fact that the carbocation is planar allows attack from both sides of the plane.
(d) There are 2 moles of HBr.

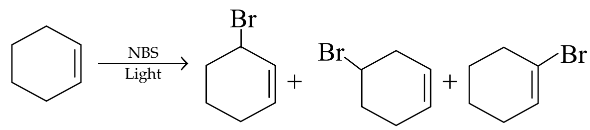
101. Which of the two products has a lower activation energy for formation?

(a) 1, 4-addition product.
(b) 1, 2-addition product.
(c) The products have same activation energy.
(d) The relative activation energy cannot be determined.

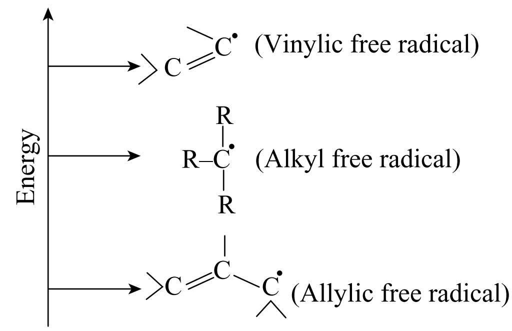
Passage 3

Karl Ziegler reported that alkenes react with N-bromosuccinimide (NBS) in the presence of light to give products resulting from substitution of hydrogen by bromine at the allylic position, i.e., the position next to the double bond.

Let us consider the halogenation of cyclohexene

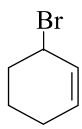
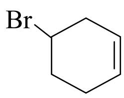
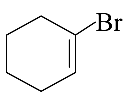


Energy level diagram for allylic, vinylic and alkylic free radicals is given

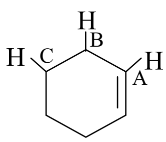


Answer the following questions

102. In the treatment of cyclohexene with NBS, which of the following products will be formed?

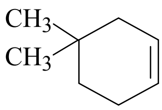
(a) 
(b) 
(c) 
(d) cannot be predicted

103. Consider the three types of C—H bonds in cyclohexene



Which of the following is/are correctly matched?

(a) A-Vinylic C–H bond (b) B-Allylic C–H bond
(c) C-Alkylic C–H bond (d) All of these

104. 

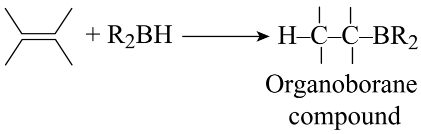
(4, 4-dimethyl cyclohexene)

Above compound on treatment with NBS gives allylic bromides. How many product(s) will be obtained in this reaction (neglecting stereoisomers)?

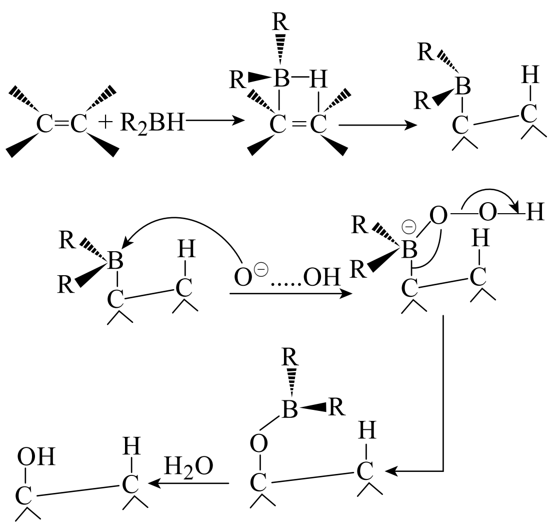
(a) One (b) Two (c) Three (d) Four

Passage 4

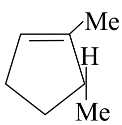
Hydroboration is a reaction in which boron hydride acts as an electrophile. R_2BH adds to a carbon–carbon double bond which acts as a nucleophile

i.e., 

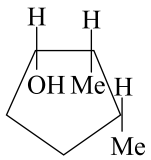
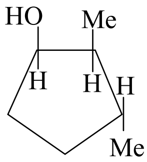
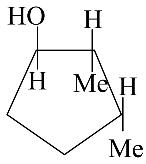
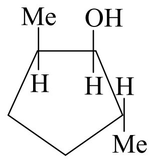
The organoborane compound then is oxidised by treatment with hydrogen peroxide in aqueous medium to form alcohol. The OH-group enters the carbon atom from the same side where the boron atom was present.



Hence this reaction is highly regioselective and the boron atom attaches to that carbon atom which is less stearically hindered.

105. 

$\xrightarrow[\text{(ii) } H_2O_2/OH]{\text{(i) } B_2H_6}$ A; Hence, compound A is

(a)  (b)  (c)  (d) 

106. R–CH=CH_2 $\xrightarrow{NOCl}$ X; Hence, X is

(a) R–CH(NO)–Cl (b) R–CH(NO)–CH_2–Cl (c) R–CHO + CH_2Cl_2 (d) R–CH(Cl)–CH_2–NO

107. R–CH = CH_2 + CO + H_2 $\xrightarrow{[Co_2(CO)_8]}$ A; Hence, A is

(a) R–CH_2CH_2CHO (b) R–CH(CHO)–CH_3

(c) R–CH=CH–CHO (d) Both (a) and (b)

Passage 5

Compound having atleast one π-bond gives addition reaction. Alkene behaves as a nucleophile and hence it gives an electrophilic addition reaction. Electrophilic addition reaction in most of the cases takes place by formation of carbocation as reaction intermediate.

108. Which one of the following is NOT correct for electrophilic addition of alkenes?

(a) In the first step, alkene reacts with electrophile to form a π-complex.

(b) π-complex converts into carbocation and the step is a rate-determining step.

(c) Product formation takes place by formation of most stable reaction intermediate.

(d) Rearrange product is not formed in addition reaction with HBr.

109. Consider the following statements

(i) Unsymmetrical alkene gives addition product according to Markovnikov's rule.

(ii) Addition reaction is a regioselective reaction.

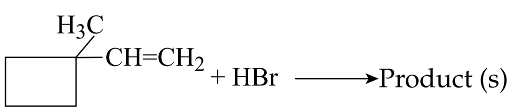
(iii) Rearranged product is formed in addition reaction.

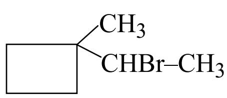
(iv) Alkene gives mixed addition product with NaCl/HOH/H^+.

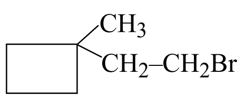
Which one is/are correct?

(a) i, ii, iii and iv (b) ii, iii and iv (c) i, iii and iv (d) i, ii and iv

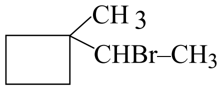
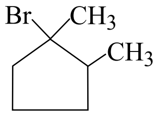
110. In the given reaction



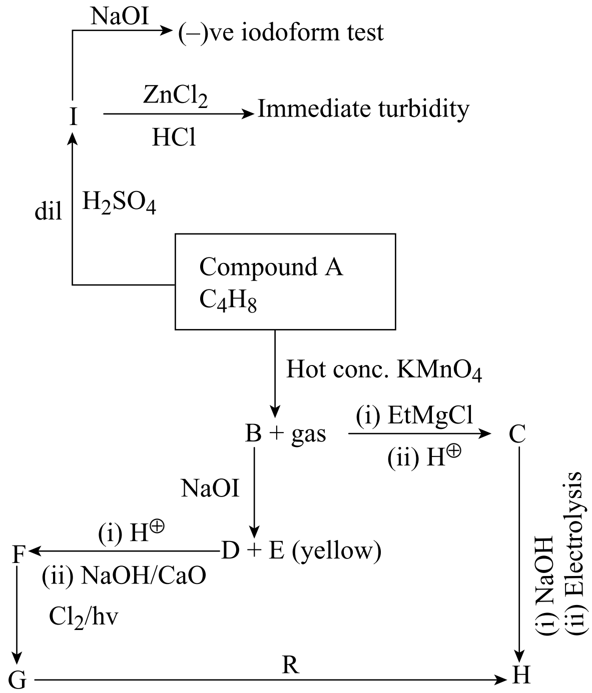
(a) 

(b) 

(c) Mixture of (A) and (B)

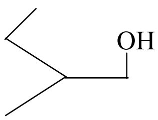
(d) Mixture of  and 

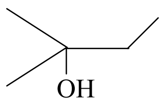
Passage 6

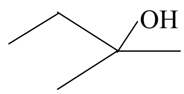


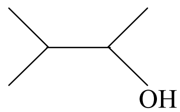
111. Compound B $\xrightarrow{\underset{PPh_3}{\overset{CH-CH_3}{||}}}$ X-compound $\xrightarrow[(2)\ NaOH/H_2O_2]{(1)\ B_2H_6-THF}$ Y-compound

Identify structure of compound Y

(a) 

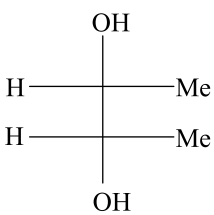
(b) 

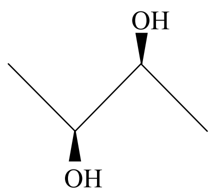
(c) 

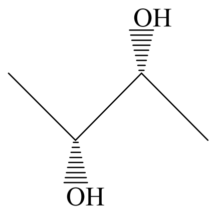
(d) 

112. (Compound E) $\xrightarrow{Ag/\Delta}$ Comp. 1 $\xrightarrow[(2)\ 2eq.CH_3I]{(1)\ 2eq.NaNH_2}$ Comp. 2 $\xrightarrow[H_2]{Pb/BaSO_4}$ Comp. 3 $\xrightarrow[(2)\ NaHSO_3\ (Aqueous)]{(1)\ OsO_4}$ Comp. 4

Identify stereochemistry compound 4

(a) 

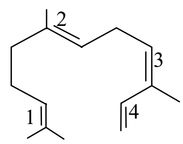
(b) 

(c) 

(d) (B) and (C) both

Passage 7

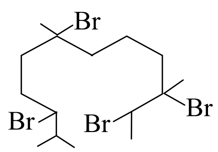
A terpene that is contained in the oil of citronella is α-farnesene. Refer to the structure of α-farnesene to answer the following questions.

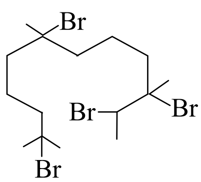


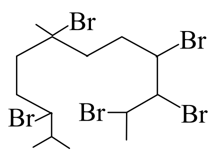
113. What reaction conditions could be used to produce acetone from α-farnesene?

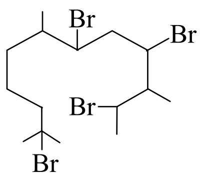
(a) H_2SO_4 and heat
(b) HBr
(c) O_3 and $(CH_3)_2S$
(d) dil. acid and cold conditions

114. If α-farnesene is reacted with an excess HBr, what would be the product?

(a) 

(b) 

(c) 

(d) 

115. In the reaction of α-farnesene with excess HBr, which double bond would be slowest to react?

(a) The bond labelled 1
(b) The bond labelled 2
(c) The bond labelled 3
(d) The bond labelled 4

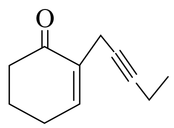
Passage 8

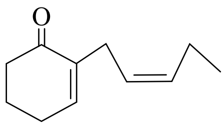
Hydrogenation of alkenes and alkynes takes place in the presence of certain catalysts. In Sabatier Senderen's reaction, the addition of hydrogen takes place in the presence of Raney nickel catalyst. Platinum and palladium can also be used as catalysts in these reactions. These are heterogeneous catalysts and used in finely divided state. Experimentally, it is observed that less crowded alkenes adsorb H_2 with faster rate. Controlled hydrogenation of alkyne in the presence of Lindlar's catalyst yields cis product, i.e., "cis" alkene. Thus, in the presence of Lindlar's catalyst "syn" addition takes place. The relative rate of hydrogenation follows the order

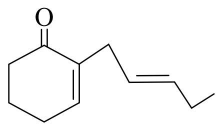
$$—C{\equiv}C— > {>}C{=}C{<} > {>}C{=}O > C_6H_6$$

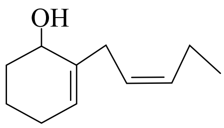
Non-terminal alkynes are reduced in the presence of Na or Li metal dissolved in liquid ammonia. In this reaction, anti addition of hydrogen results into the trans-product.

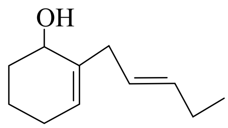
116. The product of the following reaction is

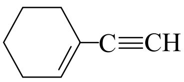
 $+ H_2 \xrightarrow[\text{Boiling quinoline}]{Pd/CaCO_3} A$

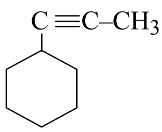
(a) 

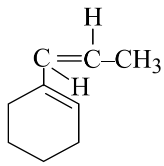
(b) 

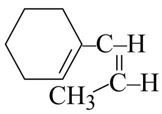
(c) 

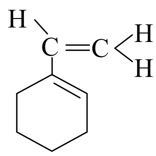
(d) 

117.  $\xrightarrow[\text{(ii) } CH_3Br]{\text{(i) } NaNH_2,\ NH_3}$ (A) $\xrightarrow[\text{Lindlar's catalyst}]{H_2}$ (B); Product (B) is

(a) 

(b) 

(c) 

(d) 

118. $CH_3–C≡C–CH_3 + H_2 \xrightarrow[\text{Boiling quinoline}]{Pd/CaCO_3}$ (A); The product (A) will be

(a) $CH_3CH_2CH_2CH_3$

(b) $\begin{matrix} H \\ CH_3 \end{matrix}\!>C=C<\!\begin{matrix} H \\ CH_3 \end{matrix}$

(c) $\begin{matrix} CH_3 \\ H \end{matrix}\!>C=C<\!\begin{matrix} H \\ CH_3 \end{matrix}$

(d) $CH_3–CH_2–CH=CH_2$

Passage 9

The structure of alkyne is linear. Terminal alkyne is acidic in character. It reacts with base to give acid–base reaction. Alkyne is nucleophile and gives electrophilic as well as nucleophilic addition reaction.

119. Which one of the following compounds forms carbonyl production reaction with 1% $HgSO_4$ + dil.H_2SO_4?

(a) $CH_2 = CH_2$
(b) $CH_3 - C \equiv C - C_6H_5$
(c) $CH_3 - C \equiv C - CH_3$
(d) Cyclohexene

120. Terminal alkyne will react with which of the following?

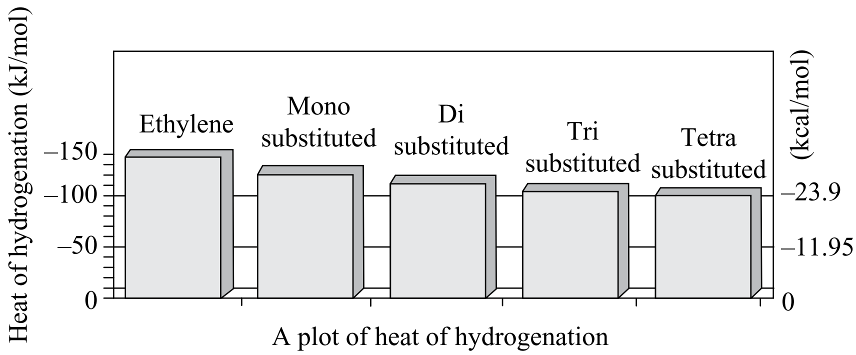
(a) Tollen's reagent
(b) Sia_2BH/THE
(c) $H_2O/HgSO_4/H_2SO_4$(d)
All of these

121. Which one of the following will react with $NaNH_2$?

(a) $CH_3 - CH_3$ (b) $CH_2 = CH_2$ (c) $CH_3 - C \equiv CH$ (d) $CH_3 - C \equiv C - CH_3$

Passage 10

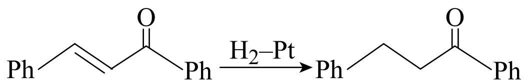
Following figure is given to test analytical ability. Based on it, answer the questions at the end of it.



A plot of heat of hydrogenation versus substitution pattern for alkenes

Catalytic hydrogenation is usually a stereospecific reaction called syn addition.

- The C≡C bond is reduced more readily than C=C but other unsaturated groups (except nitro and acid chlorides) are reduced less readily. Catalytic hydrogenation can, therefore, be used for the selective reduction of C=C in the presence of aromatic rings and carbonyl groups, whether or not the unsaturated functions are conjugated.

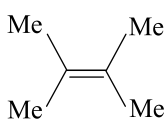


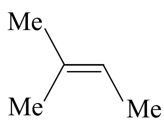
The rate of hydrogenation of olefinic bonds under standard state is

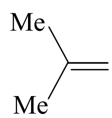
$$–CH=CH_2 > –CH=CH–$$

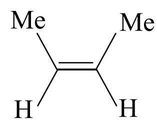
or a ring double bond

122. Base on the data of heat of hydrogenation, which has maximum stability?

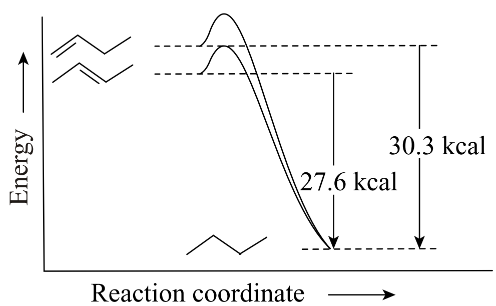
(a) 

(b) 

(c) 

(d) 

123. Consider following graph



From this, it is clear that

(a) cis-2-butene is more stable than 1-butene by 2.7 kcal
(b) trans-2-butene is more stable than 1-butene by 2.7 kcal
(c) trans-2-butene is more stable than cis-2-butene by 11 kJ
(d) trans-2-butene is more stable than 1-butene by 11 kJ

124. Bond energies (in kcal mol^{-1}) of different types of bonds have been given as >C=C< (π bond=40); H–H=(104) and >C–H=(87).

$$-\overset{|}{C}=\overset{|}{C}- \; + \; H-H \longrightarrow -\overset{|}{\underset{\underset{H}{|}}{C}}-\overset{|}{\underset{\underset{H}{|}}{C}}-$$

Heat of hydrogenation of the above reaction is

(a) 57 kcal mol^{-1} (b) –57 kcal mol^{-1} (c) –30 kcal mol^{-1} (d) 30 kcal mol^{-1}

Passage 11

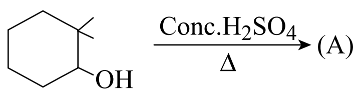
Strictly speaking, then, dehydration is not an E1 reaction of the protonated alcohol. In a true E1 elimination, the rate of reaction depends only upon heterolysis step, since every carbocation formed goes rapidly on to the product, that is, loss of a proton is much faster than regeneration of substrate. Here that is not the case for carbocations are formed reversibly from the protonated alcohol, and every so often one looses a proton to yield an alkene. Where the structure of alkyl group permits, rearrangement takes place. The initially formed carbocation rearranges to a more stable carbocation. The alkenes obtained are those formed by a loss of proton from this rearranged carbocation as well as from the original one.

When more than one alkene can be formed the preferred product is the more stable one. Another factor comes in here. Since dehydration is reversible, the composition of the product does not necessarily reflect which alkene is formed faster but depending upon how nearly reaction approaches equilibrium which alkene is more stable.

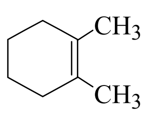
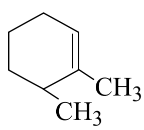
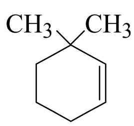
125. When neopentyl alcohol, $(CH_3)_3C\,CH_2OH$ is heated with an acid, it is slowly converted to a 85:15 mixture of two alkenes of formula C_5H_{10}. The 85% of these alkene is

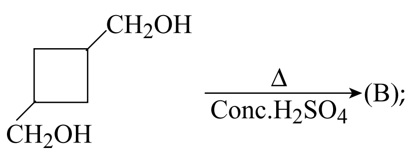
(a) $CH_3-\underset{\underset{CH_3}{|}}{C}=CH_2$ (b) $CH_3-\underset{\underset{CH_3}{|}}{C}-CH=CH_2$

(c) $CH_3-\underset{\underset{CH_3}{|}}{C}=CH-CH_3$ (d) $CH_2=\underset{\underset{CH_3}{|}}{C}-CH_2-CH_3$

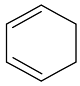
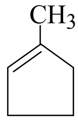
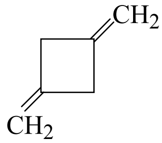
126. 

The product (A) is

(a)  (b)  (c)  (d) None

127. 

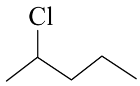
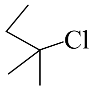
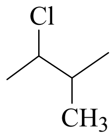
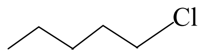
The product (B) is

(a)  (b)  (c)  (d) None

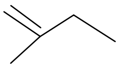
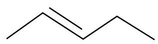
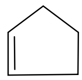
Passage 12

An organic compound A($C_5H_{11}Cl$) is optically active and on treatment with ethanolic KOH solution yields B(C_5H_{10}) as a major product, which does not show stereoisomerism. Also A on treatment with $(CH_3)_2CuLi$ yields C(C_6H_{14}), which is optically inactive. Deduce structures of A to C.

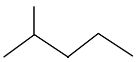
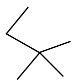
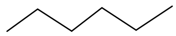
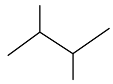
128. Identify structure of "A" compound

(a)  (b)  (c)  (d) 

129. Identify structure of "B" compound

(a)  (b) $CH_3CH{=}\overset{\overset{\large CH_3}{|}}{C}{-}CH_3$ (c)  (d) 

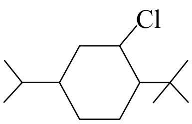
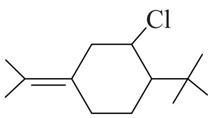
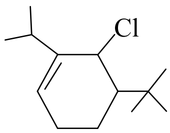
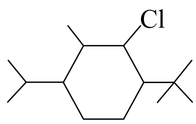
130. Identify structure of "C" compound

(a)  (b)  (c)  (d) 

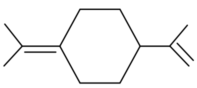
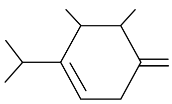
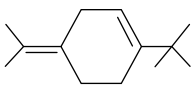
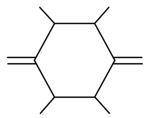
Passage 13

An organic compound A($C_{13}H_{23}Cl$) exists as distereomers and decolourise bromine water. A on treatment with ethanolic solution of KOH produces isomeric B and C with their molecular formula $C_{13}H_{22}$. Treatment of either B or C with Rany Nickel produces 4-isopropyl-1-tertiarybutyl cyclohexane. A on oxidative ozonolysis gives acetone as one product. Identify A, B and C considering C to be enantiomeric.

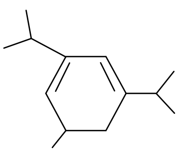
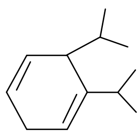
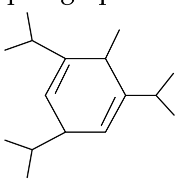
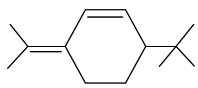
131. According to the information given in the above paragraph compound (A) will be

(a)  (b)  (c)  (d) 

132. According to the information given in the above paragraph compound (B) will be

(a)  (b)  (c)  (d) 

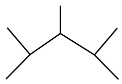
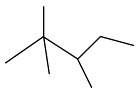
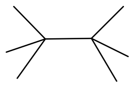
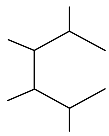
133. According to the information given in the above paragraph compound (C) will be

(a)  (b)  (c)  (d) 

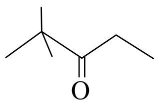
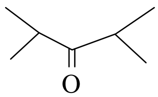
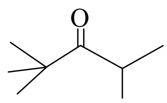
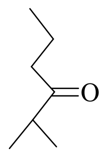
Passage 14

An optically active hydrocarbon A has molecular formula C_8H_{18}. A on monochlorination gives five alkyl halide B to F with their molecular formula $C_8H_{17}Cl$. B does not undergo dehydrohalogenation on treatment with alcoholic solution of KOH. Treatment of either C or D with alcoholic KOH yields same alkene G(C_8H_{16}), which on ozonolysis followed by work-up with Zn-dimethyl sulphide gives an optically inactive compound $C_6H_{12}O$ and ethanal. Also C is enantiomeric, whereas D is distereomeric. E on dehydrohalogenation yields an alkene, which on reductive ozonolysis yields H($C_7H_{14}O$), which is optically inactive. H on treatment with $LiAlH_4$ yields I($C_7H_{16}O$) which can be resolved into enantiomers. F on dehydrohalogenation yields an alkene (C_8H_{16}), which on reductive ozonolysis yields J($C_7H_{14}O$), which is optically active and has same configuration as that of A. Identify A to J explaining the reactions involved.

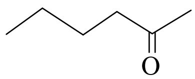
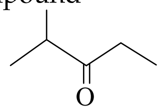
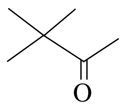
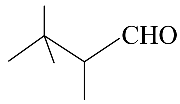
134. Identify structure of "A" compound

(a)  (b)  (c)  (d) 

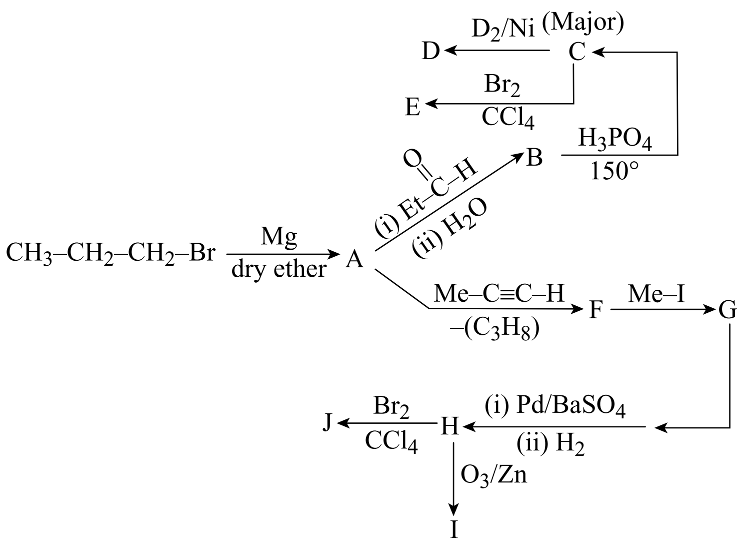
135. Identify structure of "H" compound

(a)  (b)  (c)  (d) 

136. Identify structure of "J" compound

(a)  (b)  (c)  (d) 

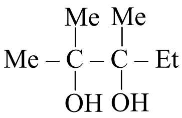
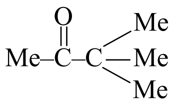
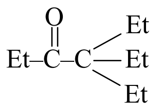
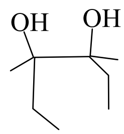
Passage 15



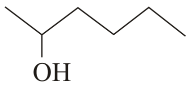
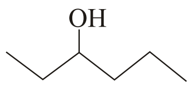
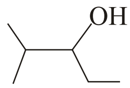
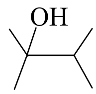
137. Identify "Z" compound

$$X \xrightarrow[H_2O]{Mg-Hg} Y \xrightarrow{H^{\oplus}} Z$$

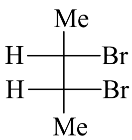
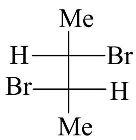
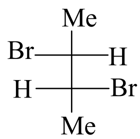
where X is a functional isomer of "W" which is next higher homologue of "I"

(a)  (b)  (c)  (d) 

138. In the above reaction sequence "B" compound is

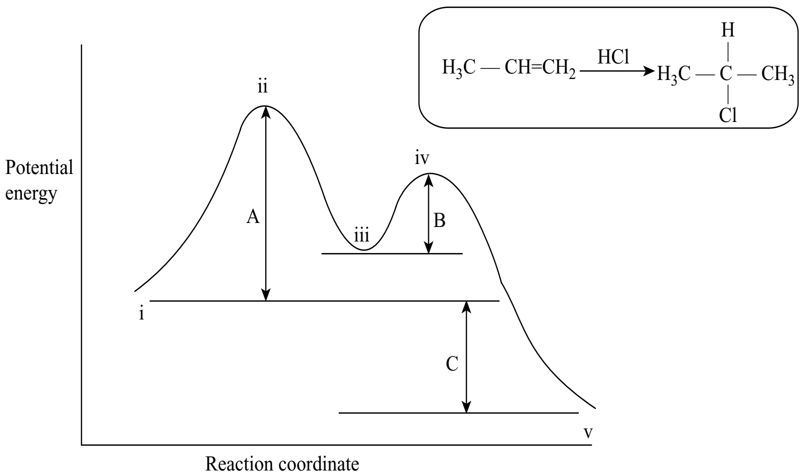
(a)  (b)  (c)  (d) 

139. In the above reaction sequence "J" compound is

(a)  (b)  (c)  (d) both (b) and (c)

Passage 16

Based on the potential energy diagram for the following reaction



140. Is this an endothermic or exothermic reaction?

(a) Endothermic
(b) Exothermic
(c) There is not enough information to determine.
(d) This reaction can be either exothermic or endothermic.

141. What is B representing in this potential energy diagram?

(a) heat of reaction: the energy required for the reaction to occur
(b) heat of reaction: the overall energy change for this reaction
(c) activation energy: the energy required for the reaction to occur
(d) activation energy: the overall energy change for this reaction

142. What is C representing in this potential energy diagram?
(a) heat of reaction: the energy required for the reaction to occur
(b) heat of reaction: the overall energy change for this reaction
(d) activation energy: the energy required for the reaction to occur
(d) activation energy: the overall energy change for this reaction

143. What is ii representing in this potential energy diagram?
(a) transition state (b) intermediate
(c) activation energy (d) heat of reaction

144. What is iii representing in this potential energy diagram?
(a) transition state (b) intermediate
(c) activation energy (d) heat of reaction

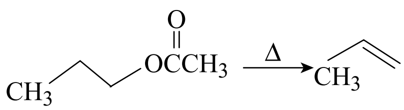
145. Which step is the rate-determining (rate-limiting) step?
(a) from i to v (b) from i to iii (c) from ii to iii (d) from iii to v

Matrix Type

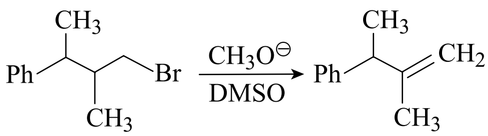
146. **Column I (Reaction)** — **Column II (Type of reaction)**

(a) 

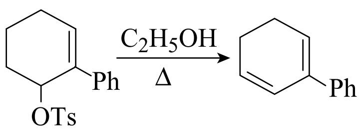
(p) $\mathbf{E_1}$

(b) 

(q) $\mathbf{E_2}$

(c) 

(r) $\mathbf{E_{1CB}}$

(d) 

(s) $\mathbf{E_i}$

147. **Column I** — **Column II (Type of reaction)**

(a) $(CH_3)_3C—Br$ (p) E_1 CB

(b) $CH_3–CH(Cl)–CH_3$ (q) First-order kinetics

(c) $CH_3–CH_2–CH(Br)–CH_3$ (r) E_1

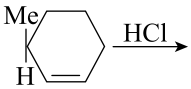
(d) $C_6H_5–CH_2–CH(F)–CH_3$ (s) E_2

148. Column I | **Column II**

(a) $CH_2{=}CH{-}COOH + HBr$ (p) Nonregioselective

(b) cis $CH_3{-}CH{=}CH{-}C_2H_5 + KMnO_4$(cold alk.) (q) Trans addition

(c) cis $CH_3{-}CH{=}CH{-}CH_3 + X_2 \xrightarrow{CS_2}$ (r) Primary carbocation

(d) 

(s) Optically active

149. Column I (Reaction) | **Column II (Reagent)**

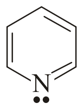
(a) $(CH_3)_3C{-}CH{=}CH_2 \longrightarrow (H_3C)_2C(OH){-}CH(CH_3)_2$ (p) $B_2H_6/H_2O_2/OH^-$

(b) $(CH_3)_3C{-}CH{=}CH_2 \longrightarrow (CH_3)_3C{-}CH(OH){-}CH_3$ (q) $H_2O/H^+/MnO_2$

(c) $H_5C_6{-}CH{=}CH_2 \longrightarrow C_6H_5{-}CHO$ (r) $Hg(OAc)_2/H_2O/NaBH_4$

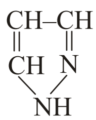
(d) $C_6H_5{-}C{\equiv}CH \longrightarrow C_6H_5{-}CH_2{-}CHO$ (s) H_2O/H^+

150. Column I | **Column II**

(a) $HC{\equiv}CH \longrightarrow$ 

(p) O_3/H_2O

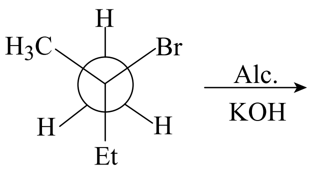
(b) $H_5C_2{-}C{\equiv}C{-}C_2H_5 \longrightarrow H_5C_2{-}C(=O){-}CH_2{-}C_2H_5$ (q) CH_2N_2 (cold ether solution)

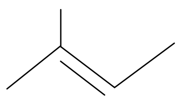
(c) $HC{\equiv}CH \longrightarrow$ 

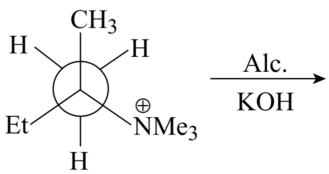
(r) HCN (Red hot Fe)

(d) $H_5C_2{-}C{\equiv}C{-}C_2H_5 \longrightarrow 2H_5C_2{-}COOH$ (s) $H_2O/H_2SO_4/HgSO_4$

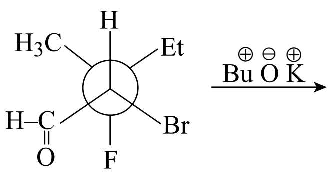
151. Column I | **Column II**

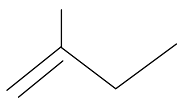
(a) 

(p) 

(b) 

(q) E^2

(c) 

(r) 

(s) E^1CB

152. Column I | **Column II**

(a) R–CH_2–X | (p) Corey-house reaction

(b) R–C(R)(R)–X | (q) Kolbe electrolysis

(c) CH_2=CH–X | (r) Wurtz reaction

(d) R–COO^- $Na^{\oplus}$ | (s) Frankland reaction

153. Column I | **Column II**

(a) But-1-yne | (p) Reacts with $KMnO_4$/KOH to give acetic acid

(b) But-2-yne | (q) With Hg^{2+}/H_2SO_4 gives butan-2-one

(c) Benzene | (r) Reacts with CH_3Cl to form but-2-yne

(d) CH_3C≡CNa | (s) Reacts with O_3/Zn/H_2O to give glyoxal

154. Column I | **Column II**

(a) Oxidative ozonolysis of alkene | (p) R–CHO (R–C≡C–R)

(b) Oxidative ozonolysis of alkyne | (q) R–COOH (R–CH=CH–R)

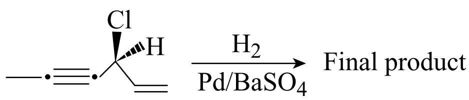
(c) Reductive ozonolysis of alkene | (r) R – C(=O) – R (R–C≡C–R)

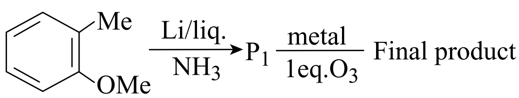
(d) Reductive ozonolysis of alkyne | (s) (R–C(=O)–C(=O)–R) (R – CH =C(R) – R)

155. Column I

(a) Me – C ≡ C – Me $\xrightarrow[\text{liq. NH}_3]{\text{Na}}$ P_1 $\xrightarrow[\text{CCl}_4]{\text{Br}_2}$ Final product

(b) Et – C ≡ C – Et $\xrightarrow[\text{liq. NH}_3]{\text{Na}}$ P_1 $\xrightarrow[\text{Ni}]{\text{D}_2}$ Final product

(c) 

(d) 

Column II

(p) Final product of reaction is racemic mixture.

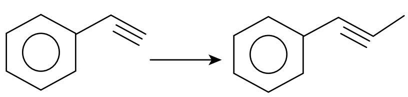
(q) Final product of reaction is meso.

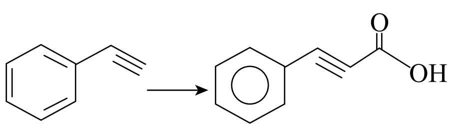
(r) Net optical rotation of final product is zero.

(s) Net optical rotation of final product is nonzero.

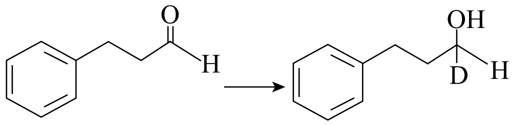
(t) Final product has one asymmetric carbon atom.

156. Column I | **Column II**

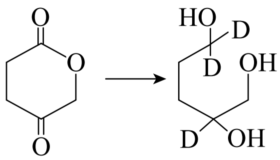
(a)  | (p) $NaBD_4$/EtOH

(b) 

| (q) $LiAlD_4$/dil. HCl

(c) 

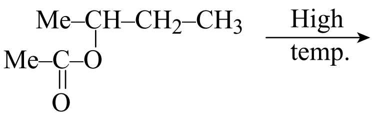
(r) $C_2H_5MgBr/CO_2/H_3O^+$

(d) 

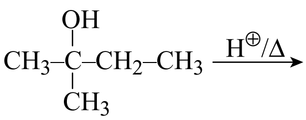
(s) $NaNH_2$/liq. NH_3/CH_3–I

(t) CH_3MgBr/CH_3–I

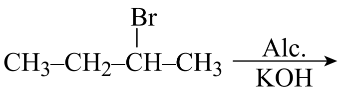
157. **Column I (Substrate for elimination reaction)** | **Column II (Type of elimination)**

(a) 

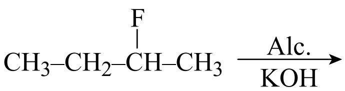
(p) E1

(b) 

(q) E2

(c) 

(r) Ei/Pyrolysis

(d) 

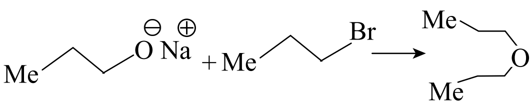
(s) Saytzeff elimination

(t) Hoffmann elimination

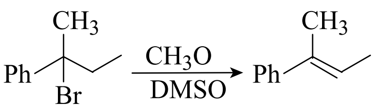
158. **Column I (reaction)** | **Column II (type of reaction: Major)**

(a) 

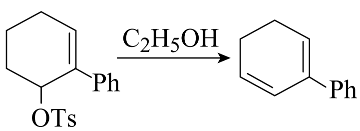
(p) E_1

(b) 

(q) E_2

(c) 

(r) E_{1CB}

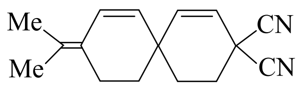
(d) 

(s) S_{N^2}

Integer Type

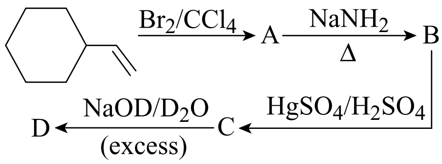
159. Number of hydrocarbons formed when C_2H_5Br and $CH_3–CH_2–CH_2–Br$ are treated with Na in the presence of dry ether is:

160. How many number of moles of H_2 is used for the complete hydrogenation of the given compound in the presence of a metal catalyst?



161. Number of different products formed by the ozonolysis of 1-4-butadiene is

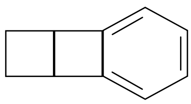
162. Consider the following reaction scheme



How many deutrium are present in the compound D?

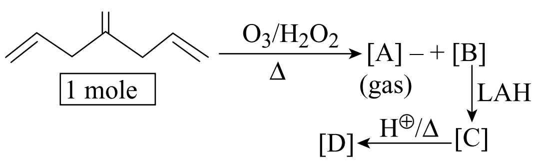
163. What volume of ethane (NTP; 1 bar, 273 K) is formed from 38 g of sodium propionate by fusion with sode lime?

164. $(CH_3)_2C{=}CH(CH_3) \xrightarrow[H_2]{\text{Catalyst}}$ Optical isomers

165. Degree of unsaturation in  is

166. Minimum number of C-atoms in alkynes to show optical isomerism is

167. Number of products obtained on ozonolysis of 1, 2-dimethyl benzene is

168. 

If X = Number of moles of CO_2

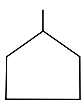
Y = Number of α–H in "D" compound

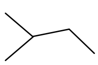
X + Y = Z

Identify value of "Z".

169. An optically active compound A has the molecular formula C_6H_{10}. The compound gives a precipitate when treated with $Ag(NH_3)_2OH$. On catalytic hydrogenation, A yields $B(C_6H_{14})$, which is optically inactive. Identify total number of "α" "H" in product formed by treatment of A with O_3/H_2O_2 then LAH and then $H^{\oplus}/\Delta$.

170. Consider the following reactions

 $\xrightarrow{Cl_2/hv.}$ Total number of monochlorinated product = X (Excluding stereoisomers)

 $\xrightarrow{Cl_2}$ Total number of monochlorinated product = X (Excluding stereoisomers)

Identify value of X + Y.

Answer Keys

LEVEL 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
b	a	b	b	c	d	a	c	d	ab	a	c	b	b	b
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
c	c	b	d	a	a	d	d	c	b	d	cd	d	c	a
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
c	b	d	b	c	d	c	a	c	a	b	b	b	c	c
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
b	b	c	b	d	c	bd	c	b	c	d	b	acd	acd	ab
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
b	d	d	d	c	d	b	d	c	c	d	ac	b	abc	d
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
abcd	abcd	bd	abc	bc	a	a	ac	ab	abd	bc	bc	abcd	ad	abc
91	92	93	94	95	96	97	98	99	100					
ab	abc	ac	a	d	d	bd	abc	abcd	b					

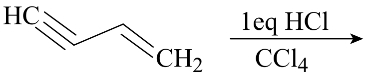
LEVEL 2

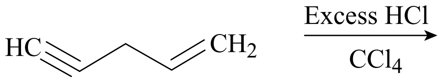
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
b	ac	c	d	d	d	a	ab	b	cd	ab	ab	d	d	d
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
abd	b	b	b	b	c	d	c	a	d	b	a	c	a	c
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
c	d	b	b	b	a	a	c	b	b	a	b	a	d	b
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
b	a	b	a	b	b	b	a	b	bc	c	ab	acd	bd	c
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
acd	ac	abd	ac	ac	bcd	abcd	b	bc	ab	b	a	a	c	d
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
a	a	c	c	b	a	a	d	b	b	b	c	c	c	b

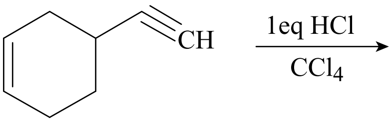
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
c	c	c	c	b	d	b	a	b	a	b	a	d	c	c
106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
d	a	d	a	d	d	a	c	b	d	a	c	b	bc	d
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
c	a	b	b	c	a	a	c	b	d	b	c	d	b	a
136	137	138	139	140	141	142	143	144	145	146(a)	146(b)	146(c)	146(d)	147(a)
d	b	b	d	b	c	b	a	b	b	r	s	q	p	qrs
147(b)	147(c)	147(d)	148(a)	148(b)	148(c)	148(d)	149(a)	149(b)	149(c)	149(d)	150(a)	150(b)	150(c)	150(d)
qrs	qrs	p	r	ps	pqs	s	s	r	q	p	r	s	q	p
151(a)	151(b)	151(c)	152(a)	152(b)	152(c)	152(d)	153(a)	153(b)	153(c)	153(d)	154(a)	154(b)	154(c)	154(d)
pq	qr	s	prs	ps	pr	q	p	pq	s	pr	q	p	s	r
155(a)	155(b)	155(c)	155(d)	156(a)	156(b)	156(c)	156(d)	157(a)	157(b)	157(c)	157(d)	158(a)	158(b)	158(c)
qrt	prt	st	r	s	r	pq	q	rt	ps	qs	qt	r	s	q
158(d)	159	160	161	162	163	164	165	166	167	168	169	170		
p	7	7	2	4	10	0	6	6	3	11	9	8		

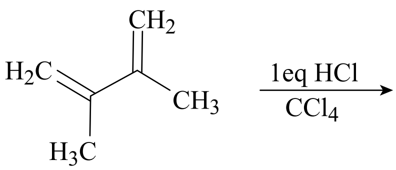
WORKBOOK EXERCISES

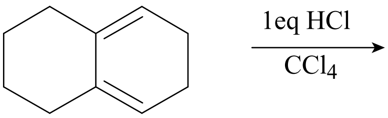
EXERCISE 1

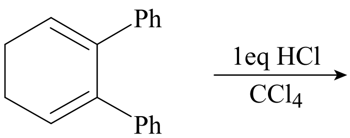
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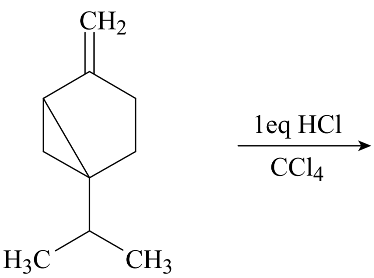
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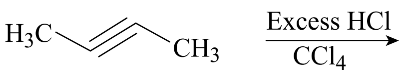
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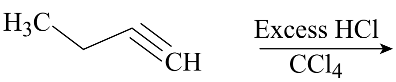
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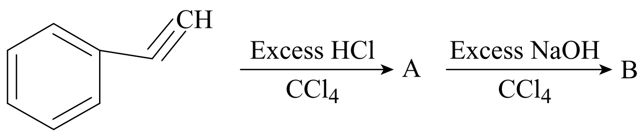
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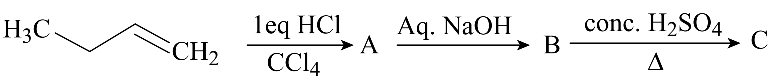
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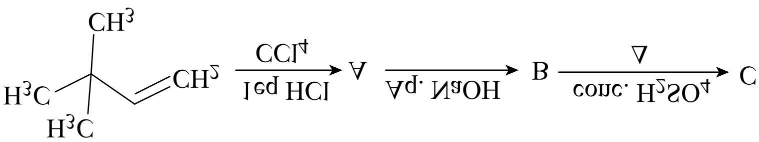
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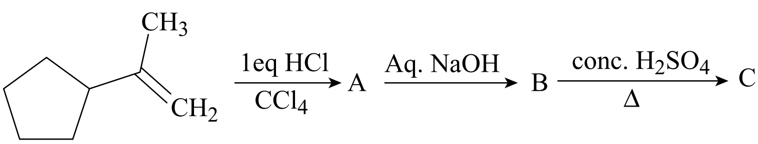
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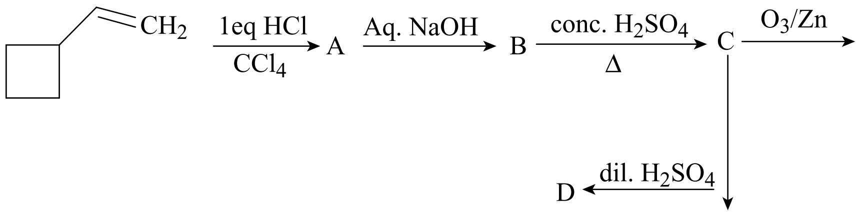
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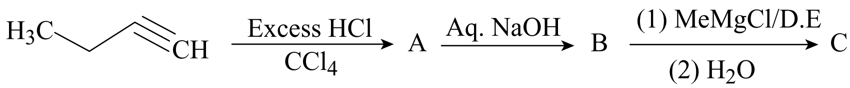
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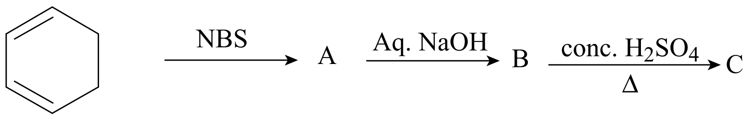
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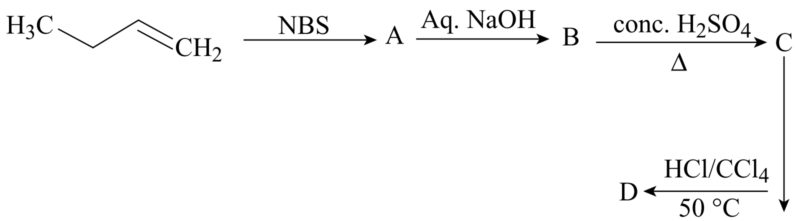
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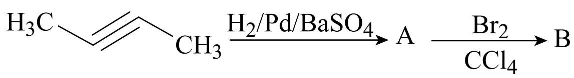
13. 

14. 
CH2
1eq HCl
CCl4
A
Aq. NaOH
B
conc. H2SO4
Δ
C
O3/Zn
dil. H2SO4
D

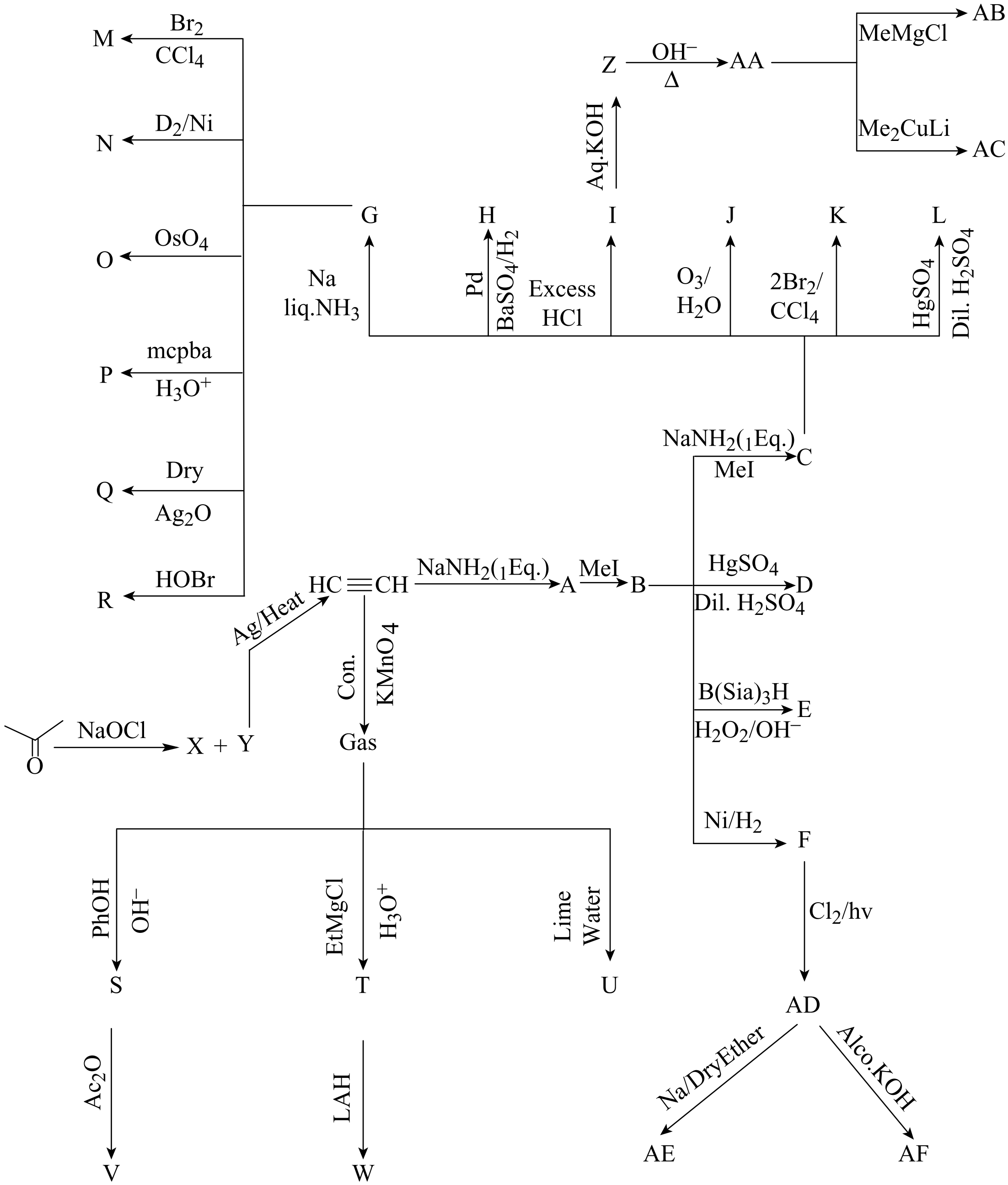
15. 
H3C
CH
Excess HCl
CCl4
A
Aq. NaOH
B
(1) MeMgCl/D.E
(2) H2O
C

16. 
NBS
A
Aq. NaOH
B
conc. H2SO4
Δ
C

17. 
H3C
CH2
NBS
A
Aq. NaOH
B
conc. H2SO4
Δ
C
HCl/CCl4
50 °C
D

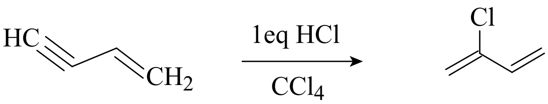
18. 
H3C
CH3
H2/Pd/BaSO4
A
Br2
CCl4
B

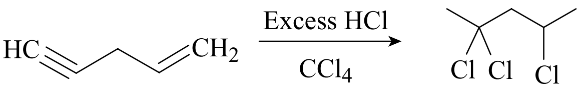
EXERCISE 2

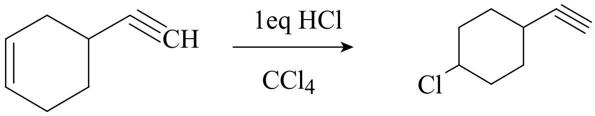

M
Br2
CCl4
N
D2/Ni
O
OsO4
P
mcpba
H3O+
Q
Dry
Ag2O
R
HOBr
G
Na
liq.NH3
H
Pd
BaSO4/H2
I
Excess
HCl
Aq.KOH
Z
OH–
Δ
AA
MeMgCl
AB
Me2CuLi
AC
J
O3/
H2O
K
2Br2/
CCl4
L
HgSO4
Dil. H2SO4
NaNH2(1Eq.)
MeI
C
HC≡CH
NaNH2(1Eq.)
A
MeI
B
HgSO4
Dil. H2SO4
D
B(Sia)3H
H2O2/OH–
E
Ni/H2
F
Cl2/hv
AD
Na/DryEther
AE
Alco.KOH
AF
Ag/Heat
O
NaOCl
X + Y
Con.
KMnO4
Gas
PhOH
OH–
S
Ac2O
V
EtMgCl
H3O+
T
LAH
W
Lime
Water
U

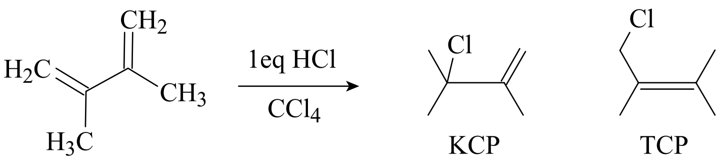
SOLUTION FOR WORKBOOK EXERCISES

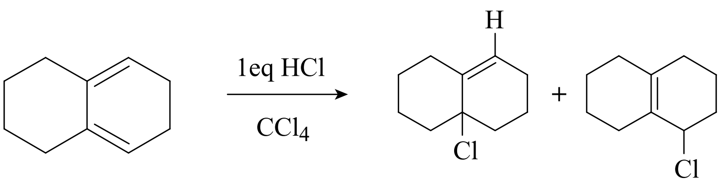
EXERCISE 1

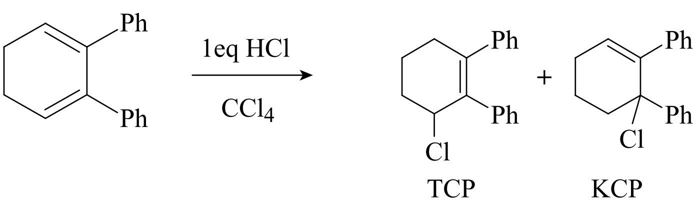
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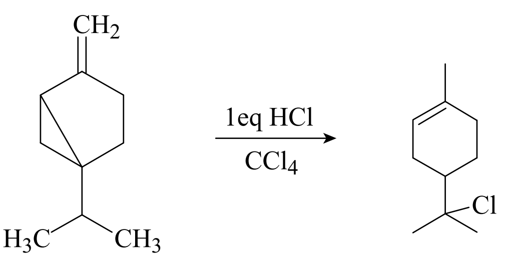
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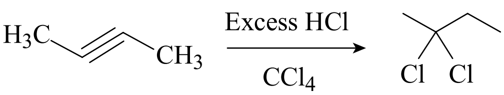
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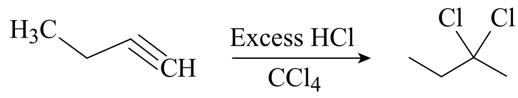
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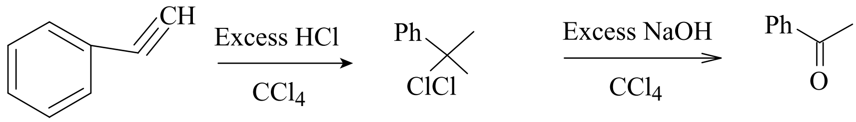
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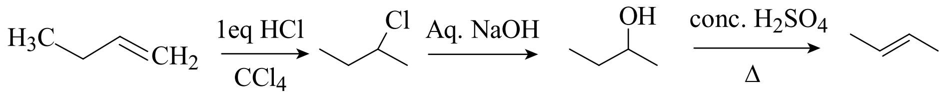
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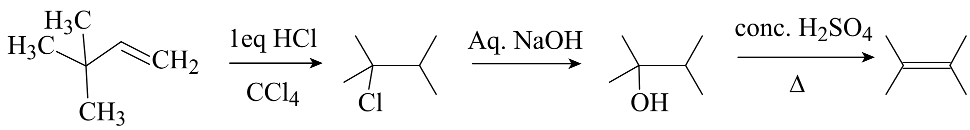
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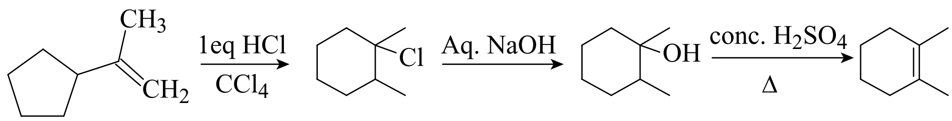
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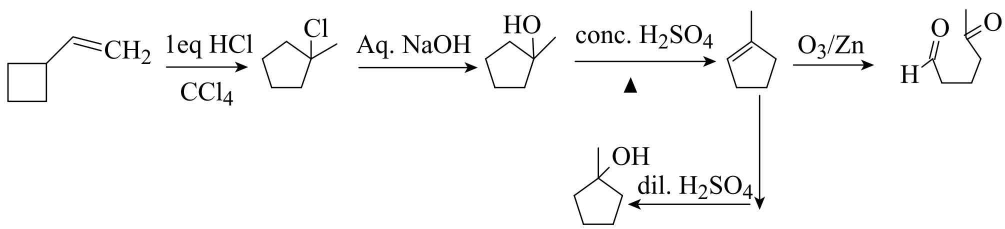
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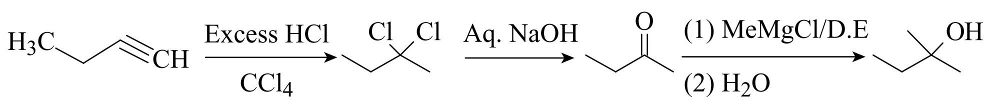
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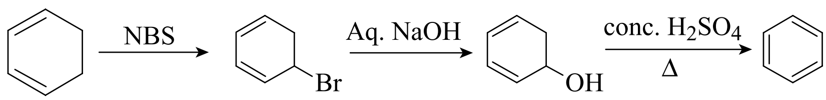
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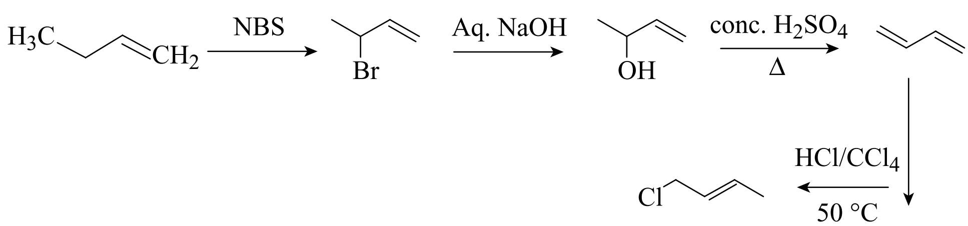
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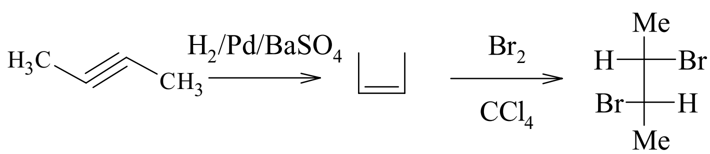
16.



17.

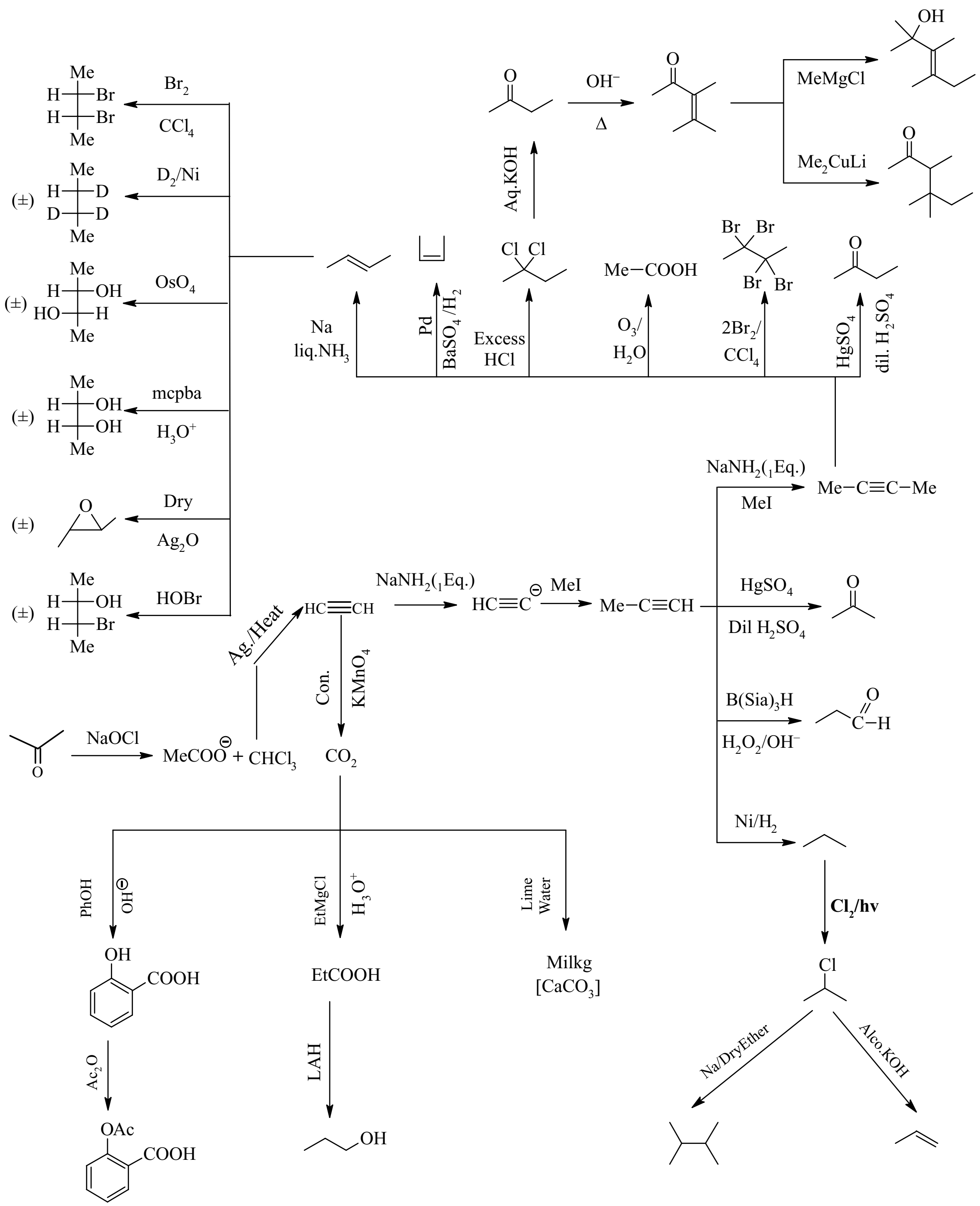


18.



(I)

EXERCISE 2



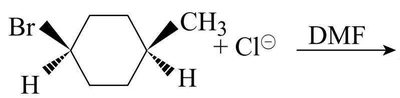
Br$_2$
CCl$_4$
D$_2$/Ni
OsO$_4$
mcpba
H$_3$O$^+$
Dry
Ag$_2$O
HOBr
(±)
Me
H
Br
D
OH
HO
O
Na
liq.NH$_3$
Pd
BaSO$_4$/H$_2$
Excess
HCl
Cl Cl
Aq.KOH
OH$^-$
Δ
MeMgCl
Me$_2$CuLi
Me−COOH
O$_3$/
H$_2$O
2Br$_2$/
CCl$_4$
HgSO$_4$
dil. H$_2$SO$_4$
NaNH$_2$($_1$Eq.)
MeI
Me−C≡C−Me
Ag./Heat
HC≡CH
NaNH$_2$($_1$Eq.)
HC≡C$^\ominus$
Me−C≡CH
HgSO$_4$
Dil H$_2$SO$_4$
B(Sia)$_3$H
H$_2$O$_2$/OH$^-$
C−H
Ni/H$_2$
Cl$_2$/hv
Cl
Na/DryEther
Alco.KOH
Con.
KMnO$_4$
NaOCl
MeCOO$^\ominus$ + CHCl$_3$
CO$_2$
PhOH
OH$^\ominus$
EtMgCl
H$_3$O$^+$
Lime
Water
COOH
EtCOOH
Milkg
[CaCO$_3$]
Ac$_2$O
LAH
OAc

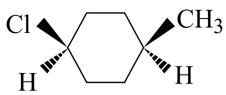
CHAPTER 4

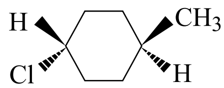
Alkyl Halides, Alcohols and Ethers

Question Bank

LEVEL 1

1. 

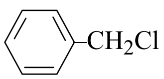
(a) 

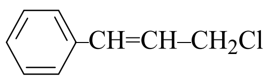
(b) 

(c) Both are correct

(d) None is correct

2. Arrange the following in the order of their reactivity of S_N2 reaction

(i) 

(ii) 

(iii) $CH_2=CH-CH_2Cl$

(iv) $CH_3CH_2CH_2Cl$

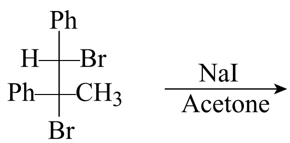
(a) iv > iii > i > ii

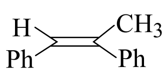
(b) ii > i > iii > iv

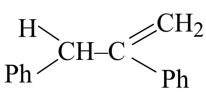
(c) i > ii > iv > iii

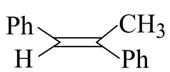
(d) iii > ii > i > iv

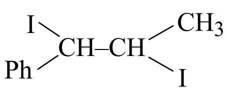
3. Identify the product of the following reaction



(a) 

(b) 

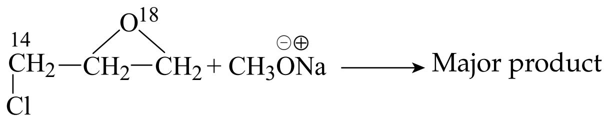
(c) 

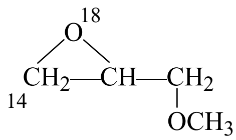
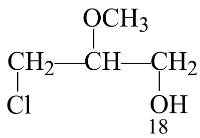
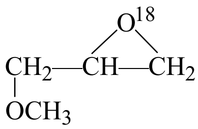
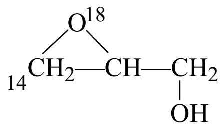
(d) 

4. The conversion of ethanol to propanenitrite is best done by

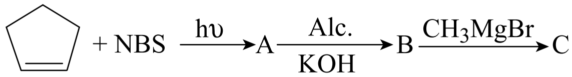
(a) $CH_3–CH_2–OH + KCN \xrightarrow{\Delta}$
(b) $CH_3–CH_2–OH + HCN \xrightarrow{\Delta}$
(c) $CH_3–CH_2–OH \xrightarrow[\text{(ii) KCN}]{\text{(i) TsCl/Pyridine}}$
(d) $CH_3–CH_2–OH + CH_3CN \xrightarrow{\Delta}$

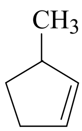
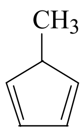
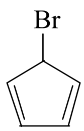
5. Major product of the following reaction is



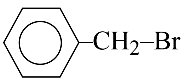
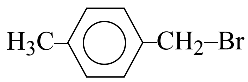
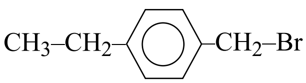
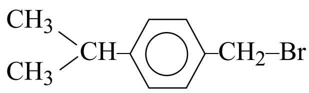
(a) 
(b) 
(c) 
(d) 

6. The final product of the following reaction is



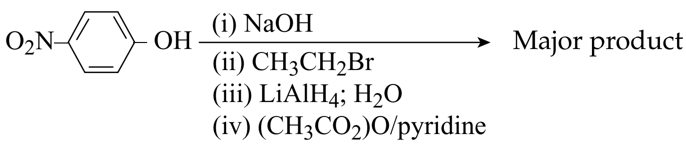
(a) 
(b) 
(c) 
(d) None of these

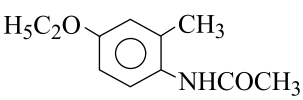
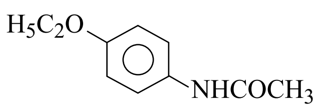
7. Arrange the following compounds in order of decreasing rate of hydrolysis for $S_N1$reaction

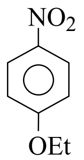
(i) 
(ii) 
(iii) 
(iv) 

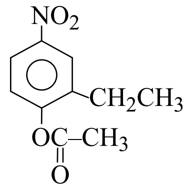
(a) iii > iv > ii > i
(b) iv > iii > ii > i
(c) ii > iii > iv > i
(d) i > ii > iii > iv

8. For the given reaction major product will be

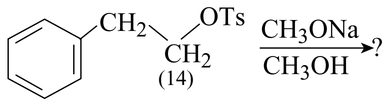


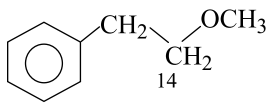
(a) 
(b) 

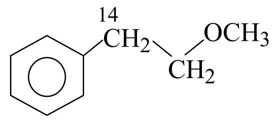
(c) 

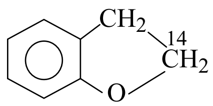
(d) 

9. The product/s formed is/are



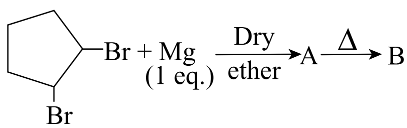
(a) 

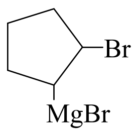
(b) 

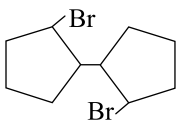
(c) 

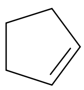
(d) Both (a) and (b)

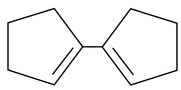
10. In the following reaction, compound (b) is

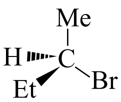


(a) 

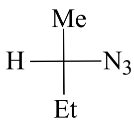
(b) 

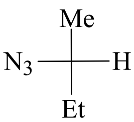
(c) 

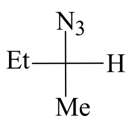
(d) 

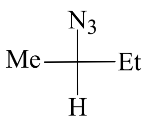
11.  + NaN_3 $\xrightarrow{DMF}$ Product

The correct representation of the product is

(a) 

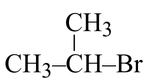
(b) 

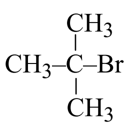
(c) 

(d) 

12. Arrange the following in the order of their reactivity with alcoholic AgCN to yield the substitution product

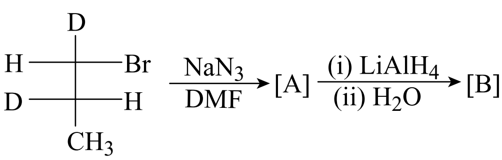
(i) $CH_3–CH_2Br$

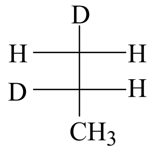
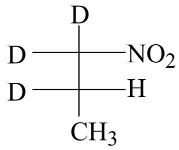
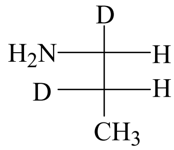
(ii) 

(iii) 

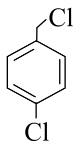
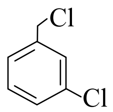
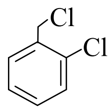
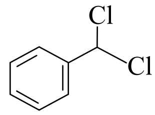
(a) i > ii > iii (b) (iii) > ii > i (c) ii > i > iii (d) i > iii > ii

13. The final product is

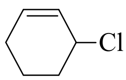
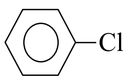
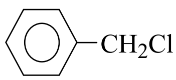


(a)  (b)  (c)  (d) None of these

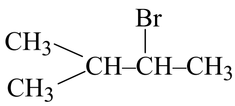
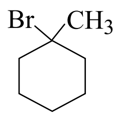
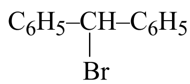
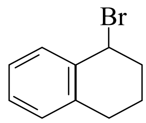
14. An aromatic compound (A), $C_7H_6Cl_2$, gives AgCl on boiling with alcoholic $AgNO_3$ solution and yields C_7H_7OCl on treatment with sodium hydroxide. (a) on oxidation gives a mono-chlorobenzoic acid which affords only one mononitroderivative. The compound (a) is

(a)  (b)  (c)  (d) 

15. Which will give white ppt. with $AgNO_3 + NH_4OH$?

(a)  (b)  (c)  (d) Both (a) and (c)

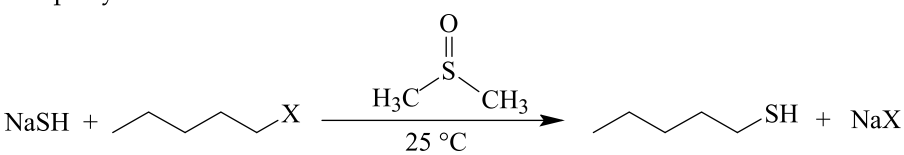
16. Consider the S_N1 solvolysis of the following halides in aqueous formic acid

(i)  (ii)  (iii)  (iv) 

Which one of the following is correct sequence of the halide given above in the decreasing order of their reactivity?

(a) iii > iv > ii > i (b) ii > iv > i > iii
(c) i > ii > iii > iv (d) iii > i > ii > iv

17. For which leaving group X would you predict the S_N2 reaction shown below to take place most rapidly?

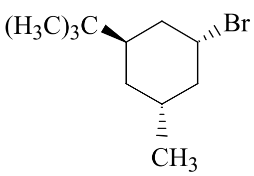
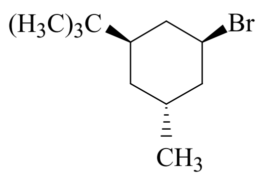


(a) X = –OH (b) X = –Cl (c) X = –Br (d) X = –I

18. Which of the following order is **correct** for dipole moment?

(a) $CH_3F > CH_3Cl > CH_3Br > CH_3I$ (b) $CH_3Cl > CH_3Br > CH_3F > CH_3I$
(c) $CH_3Br > CH_3Cl > CH_3I > CH_3F$ (d) $CH_3Cl > CH_3F > CH_3Br > CH_3I$

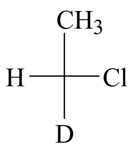
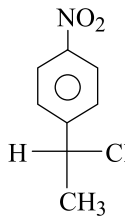
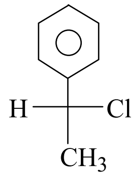
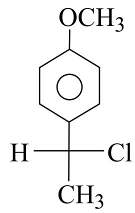
19. Choose the correct statement(s) concerning reactions of the two stereoisomers of 3-tert-butyl-5-methylbromocyclohexane.

(i)  (ii) 

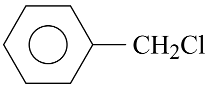
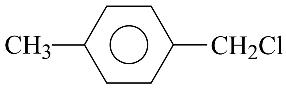
(i) 1 will undergo S_N1 reactions faster than 2
(ii) 1 will undergo E1 reactions faster than 2
(iii) 1 and 2 undergo S_N1 reactions at some rate

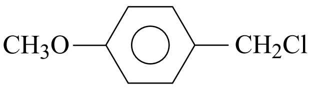
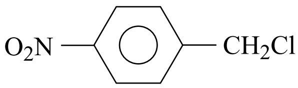
(a) i (b) ii (c) iii (d) i & ii

20. Under identical conditions, solvolysis of which of the following substrates would lead to maximum racemization?

(a)  (b)  (c)  (d) 

21. Consider the following chlorides

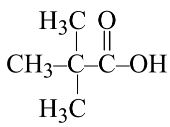
(i)  (ii) 

(iii)  (iv) 

The order of reactivity of (i), (ii), (iii) and (iv) towards hydrolysis by S_N1 mechanism is

(a) i < ii < iii < iv (b) iv < iii < ii < i
(c) iv < i < ii < iii (d) iii < ii < i < iv

22. Which of the following would be the best synthesis of the acid shown below?



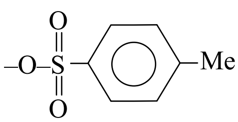
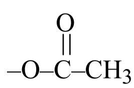
(a) $CH_3CH_2\text{–}\overset{\displaystyle O}{\overset{\|}{C}}\text{–}H \xrightarrow[Et_2O]{CH_3MgBr} \xrightarrow{H_3O^{\oplus}} \xrightarrow{SOBr_2} \xrightarrow[Et_2O]{Mg} \xrightarrow{CO_2} \xrightarrow{H_3O^{\oplus}}$

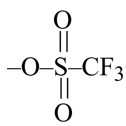
(b) $CH_3CH_2\text{–}\overset{\displaystyle O}{\overset{\|}{C}}\text{–}H \xrightarrow[Et_2O]{CH_3MgBr} \xrightarrow{H_3O^{\oplus}} \xrightarrow{SOBr_2} \xrightarrow{KCN} \xrightarrow[Heat]{H_3O^{\oplus}}$

(c) $CH_3\text{–}\overset{\displaystyle O}{\overset{\|}{C}}\text{–}CH_3 \xrightarrow[Et_2O]{CH_3MgBr} \xrightarrow{H_3O^{\oplus}} \xrightarrow{SOBr_2} \xrightarrow[Et_2O]{Mg} \xrightarrow{CO_2} \xrightarrow{H_3O^{\oplus}}$

(d) $CH_3\text{–}\overset{\displaystyle O}{\overset{\|}{C}}\text{–}CH_3 \xrightarrow[Et_2O]{CH_3MgBr} \xrightarrow{H_3O^{\oplus}} \xrightarrow{SOBr_2} \xrightarrow{KCN} \xrightarrow[Heat]{H_3O^{\oplus}}$

23. Rank the groups in order of decreasing leaving group ability

(i)  (ii) 

(iii) –OMe (iv) 

(a) ii > i > iv > iii (b) i > ii > iv > iii
(c) iv > i > iii > ii (d) iv > i > ii > iii

24. In the given reaction

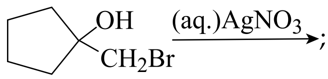
$C_6H_5–O–CH_2–CH_3 \xrightarrow{HI/\Delta} [X] + [Y]$

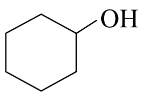
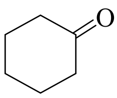
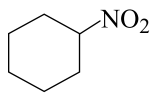
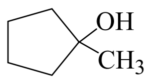
[X] and [Y] will respectively be

(a) C_6H_5I and $CH_3–CH_2–I$ (b) $C_6H_5–OH$ and $CH_3–CH_2–I$
(c) C_6H_5I and $CH_3–CH_2OH$ (d) C_6H_5OH and $CH_2=CH_2$

25. 1-Propanol can be prepared from propene by

(a) $HOH/H^{\oplus}$ (b) $Hg(OAc)_2/H_2O$ and $NaBH_4$
(c) B_2H_6–THF and H_2O_2/OH^- (d) All of these

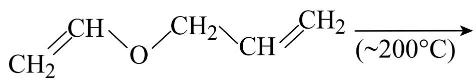
26.  ; Major product will be

(a)  (b)  (c)  (d) 

27. The decreasing order of reactivity of methyl alcohol (i), isopropyl alcohol (ii), tertiary butyl alcohol (iii) and ethyl alcohol (iv) for esterification will be

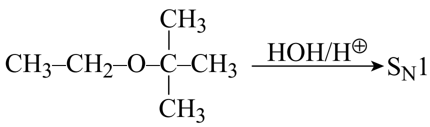
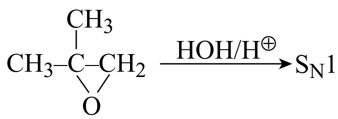
(a) i > ii > iii > iv (b) iv > iii > ii > i
(c) i > iv > ii > iii (d) i > iv > iii > ii

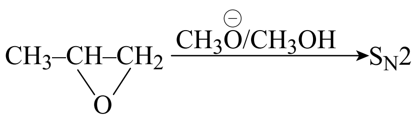
28. The product of the reaction is



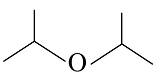
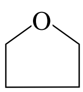
(a) $CH_2=CH–CH_2OH$ (b) CH_3CHO
(c) $CH_2=CH–CH_2–CH_2CHO$ (d) $CH_3–CH=CH–CH_2CHO$

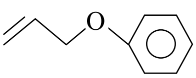
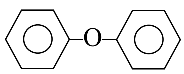
29. Which of the following is correctly matched?

(a)  (b) 

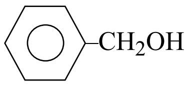
(c)  (d) All of these

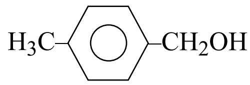
30. Which of the following ether does not give peroxide formation?

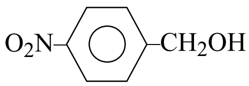
(a)  (b) 

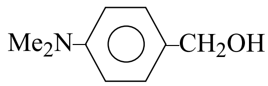
(c)  (d) 

31. Correct order of the reactivity of the given alcohols towards the substitution with (NaBr + H_2SO_4)

(i) 

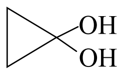
(ii) 

(iii) 

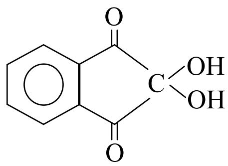
(iv) 

(a) i > ii > iii > iv (b) iv > ii > i > iii
(c) iii > i > ii > iv (d) iv > iii > ii > i

32. Which of the following is a stable hydrate?

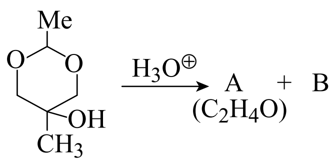
(a) 

(b) $Cl_3C-CH(OH)_2$

(c) 

(d) all of these

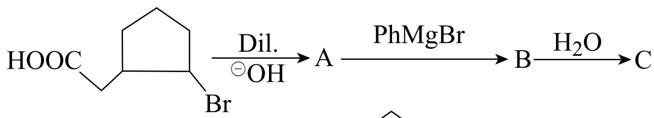
33. The products of the given reactions

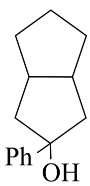


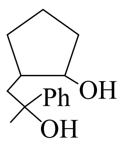
(B) $\xrightarrow{HIO_4}$ products

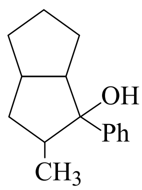
(a) CH_3CH_2COOH (b) HCHO (c) HCOOH (d) Both (a) and (b)

34. For the following reactions, the product C is



(a) 

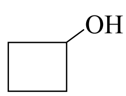
(b) 

(c) 

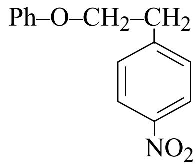
(d) none of these

35. Compound [X], whose MF is C_4H_8O gives positive haloform test but gives no 2, 4-DNP derivative is

(a) $CH_2=CH-CH(OH)-CH_3$ (b) $CH_3-CH_2-CH_2-CHO$

(c) $CH_3-CH_2-C(=O)-CH_3$ (d) 

36. When HI is added in excess to the unsymmetrical ether



it results in

(a) $PhCH_2OH$ (b) PhI
(c) $HOCH_2CH_2Ph\text{-}NO_2$ (d) $ICH_2CH_2PhNO_2$

37. $CH_3-\underset{OH}{CH}-\underset{NH_2}{CH}-COOR \xrightarrow[\text{(ii) } H_3O]{\text{(i) 1mol } HIO_4}$ Products

The product mixture will contain

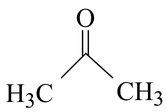
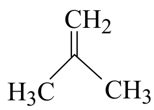
(a) $CH_3CHO + OHC–NH_2 + CO_2$ (b) CH_3COOH only
(c) $CH_3CHO + OHC–COOR + NH_3$ (d) $CH_3COOH + NH_2COOR + HCOOH$

38. Williamson's synthesis is applied to prepare ether. Identify the ether from the following which cannot be prepared by it?

(a) $(CH_3)_3C–O–CH_2CH_2CH_3$ (b) $PhOCH_3$
(c) $CH_2=CH–CH_2–O–CH_3$ (d) $CH_3–CH=CH–O–CH=CH_2$

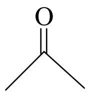
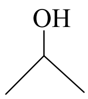
39. Which of the following predictions regarding the solubility of each pair of compounds in water are correct?

(i) CH_2Cl_2 is more soluble than CH_3OH in water

(ii)  is more soluble than  in water

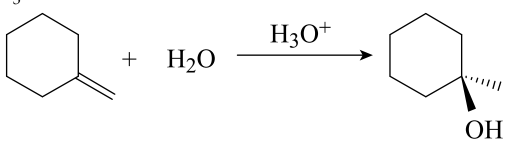
(iii) CH_3CH_2Cl is more soluble than NaCl in water

(iv) $CH_3CH_2CH_2SH$ is more soluble than $CH_3CH_2CH_2OH$ in water

(v)  is less soluble than  in water

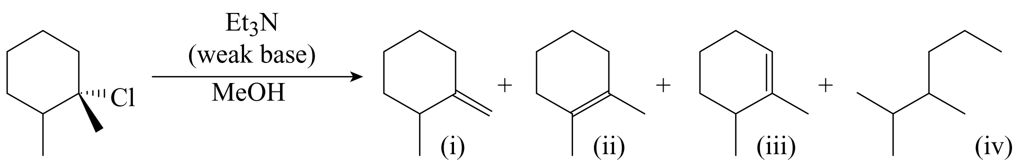
(a) iii, iv, v (b) i, ii, iv (c) ii, iv, v (d) ii, v

40. What is the role of H_3O^+ in this reaction?



(a) Nucleophile (b) Catalyst (c) Leaving group (d) Base

41. Arrange the yields (high to low) for the products of the following reaction and judge the possible mechanism.



(a) ii > iii > i > iv via E_1 mechanism
(b) ii > iv > iii > i via E_2 mechanism
(c) ii > iii > iv > i via E_1 mechanism
(d) iv > i > ii > iii via E_2 mechanism

42. What reagent can be used to convert 1-isopropylcyclopentene to 1-isopropyl-cyclopentanol?

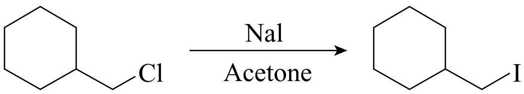
(a) HBr
(b) H_2O, diluted H_2SO_4
(c) H_2/Pd
(d) H_2O, neutral

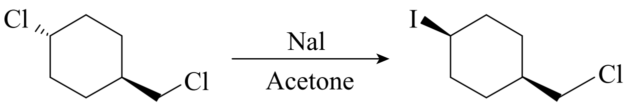
43. Which statements are true for S_N2 reaction of alkyl halides?

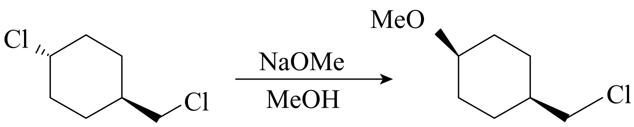
(i) Both of the alkyl halide and nucleophile are involved in the transition state.
(ii) Reaction proceeds with inversion of configuration at the substitution centre.
(iii) Reaction proceeds with retention of configuration at the substitution centre.
(iv) The order of reactivity is 3° > 2° > 1°.
(v) The nucleophile must have an unshared electron pair and bear a negative charge.
(vi) The greater the nucleophilicity of the nucleophile, the greater the rate of reaction.

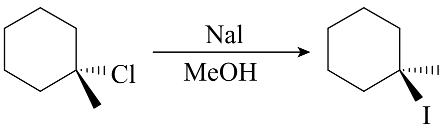
(a) i, ii, v, vi
(b) i, iii, v, vi
(c) i, ii, iv, v
(d) i, ii, vi

44. What reactions will likely occur through S_N1 mechanism?

(i) 

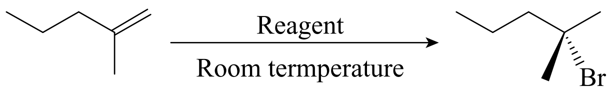
(ii) 

(iii) 

(iv) 

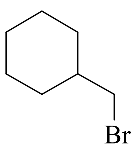
(a) ii, iii, iv
(b) i, iv
(c) iii, iv
(d) ii, iii

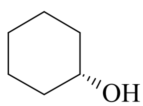
45. What is the reagent(s) needed for the following reaction?

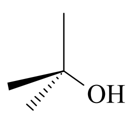


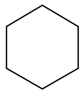
(a) HCl
(b) NaBr
(c) HBr
(d) Br_2

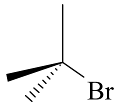
46. Which are secondary alkyl halides?

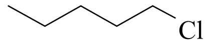
(i) 

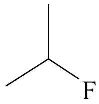
(ii) 

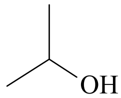
(iii) 

(iv) 

(v) 

(vi) 

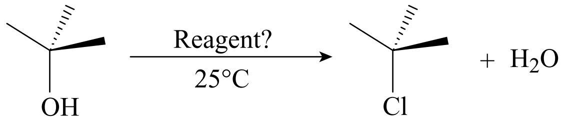
(vii) 

(viii) 

(ix) CH_3OH (x) CH_3I

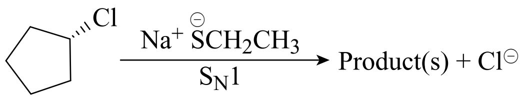
(a) i, vii (b) vii (c) v, x (d) i, v, vi, x

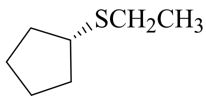
47. What reagent can be used for the following transformation?

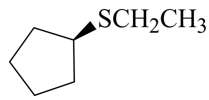


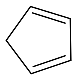
(a) HCl (b) $Na_2Cr_2O_7$ (c) Cl_2 (d) NaCl

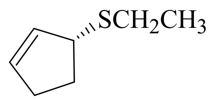
48. What could be the product(s) for the following S_N1 reaction?



(i) 

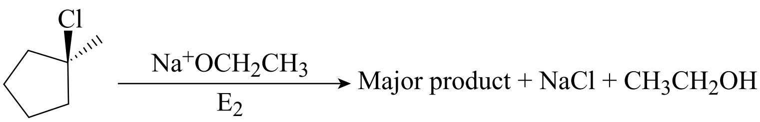
(ii) 

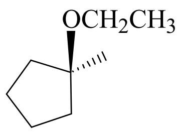
(iii) 

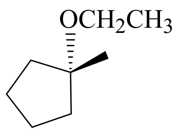
(iv) 

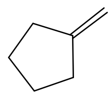
(a) i, ii (b) i, iii (c) iii, iv (d) ii, iii

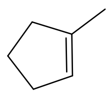
49. What could be the major product for the following E_2 reaction?



(i) 

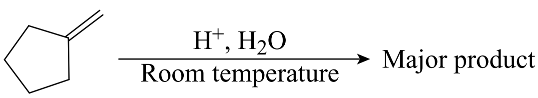
(ii) 

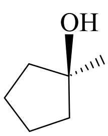
(iii) 

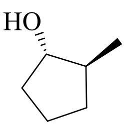
(iv) 

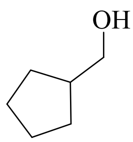
(a) i (b) ii (c) iii (d) iv

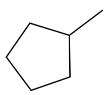
50. What could be the major product for the following reaction?



(i) 

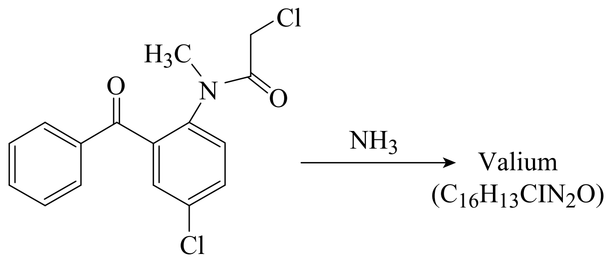
(ii) 

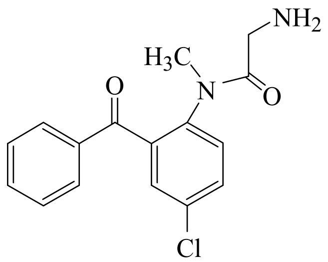
(iii) 

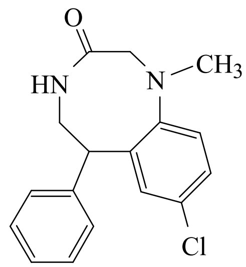
(iv) 

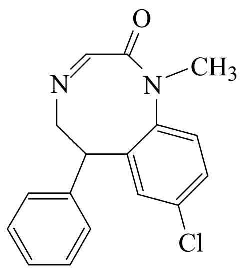
(a) i (b) ii (c) iii (d) iv

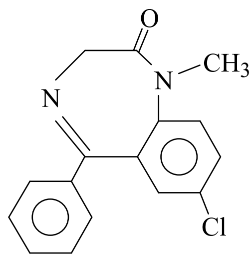
51. The last step in the synthesis of Valium® is treatment of the following aromatic compound with NH_3. Choose the correct structure of Valium®.



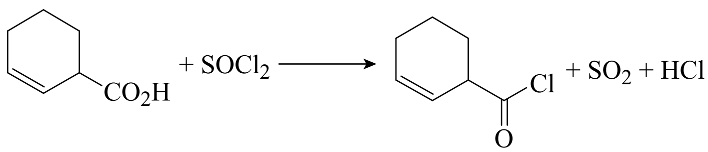
(a) 

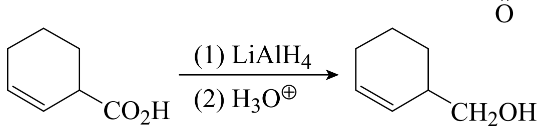
(b) 

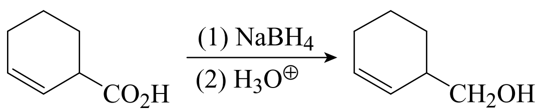
(c) 

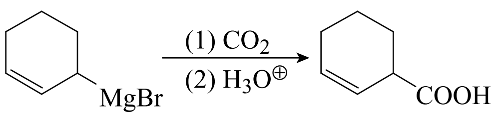
(d) 

52. Choose the reaction that is not correctly shown.

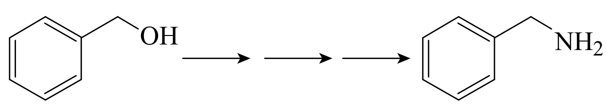
(a) 

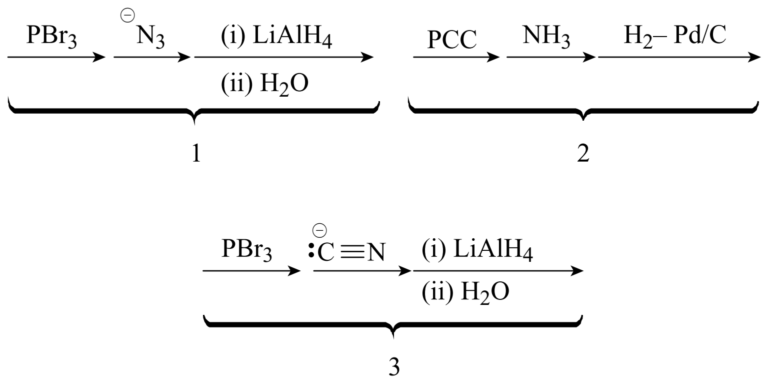
(b) 

(c) 

(d) 

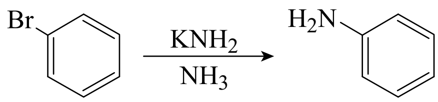
53. Choose those reactions that would give the following amine.

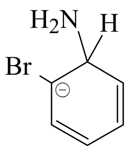


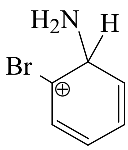


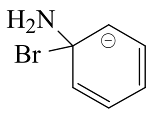
(a) 1 + 2 + 3 (b) 1 + 2 (c) 2 + 3 (d) 1 + 3

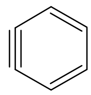
54. Bromobenzene reacts with potassium amide to form aniline. Identify the most important intermediate.



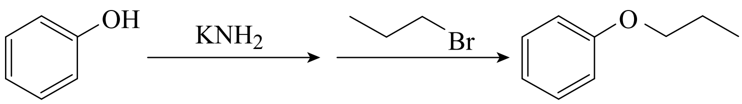
(a) 

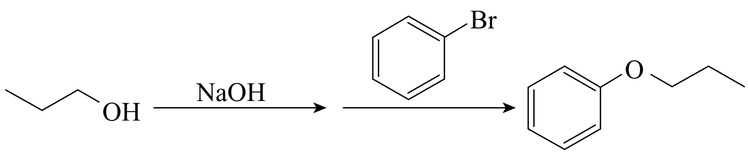
(b) 

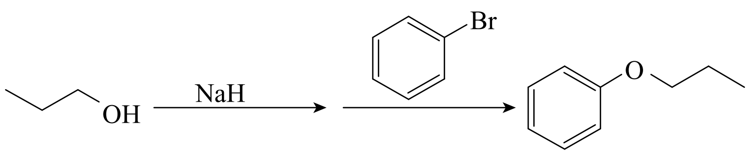
(c) 

(d) 

55. Here are three possible syntheses of phenylpropylether. Which one would work?

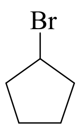
(i) 

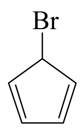
(ii) 

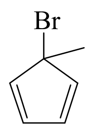
(iii) 

(a) i only (b) iii only (c) ii or iii (d) i or iii

56. Identify correct reactivity order for S_N1 reaction

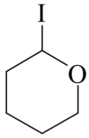
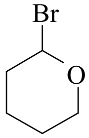
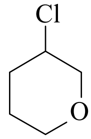
(i) 

(ii) 

(iii) 

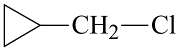
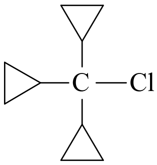
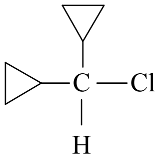
(a) i > ii > iii (b) ii > iii > i
(c) i > iii > ii (d) iii > i > ii

57. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

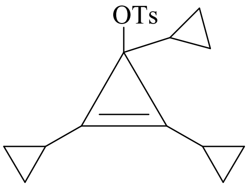
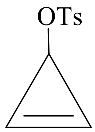
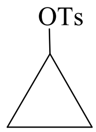
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

58. Identify correct reactivity order for S_N1 reaction.

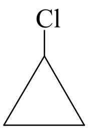
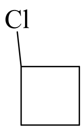
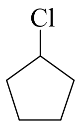
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

59. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

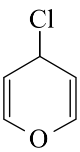
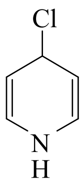
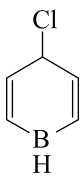
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

60. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

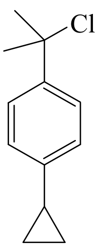
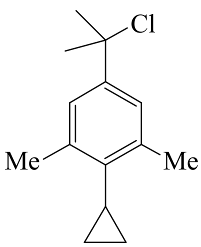
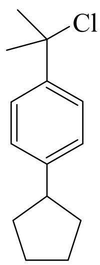
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > ii > i

61. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

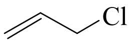
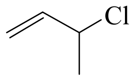
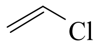
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) ii > i > iii

62. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

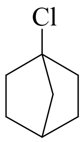
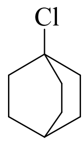
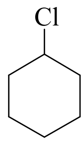
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

63. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

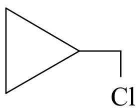
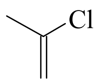
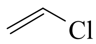
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) ii > i > iii

64. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

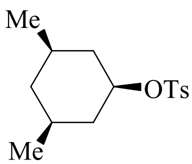
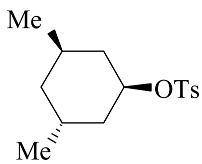
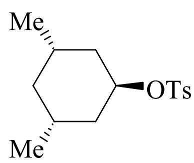
(a) i > ii > iii (b) iii > ii > i (c) i > iii > ii (d) iii > i > ii

65. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

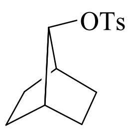
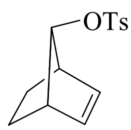
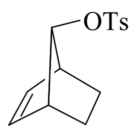
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

66. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

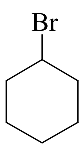
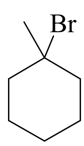
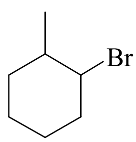
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

67. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

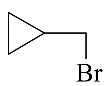
(a) i > ii > iii (b) iii > ii > i (c) i > iii > ii (d) iii > i > ii

68. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

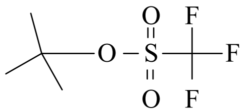
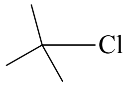
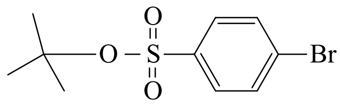
(a) i > ii > iii (b) ii > i > iii (c) i > iii > ii (d) iii > i > ii

69. Identify correct reactivity order for S_N1 reaction

(i) Ph—CH_2—Br (ii) Ph—Br (iii) 

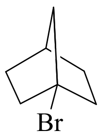
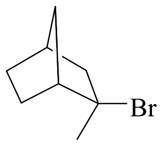
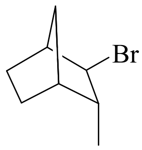
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

70. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

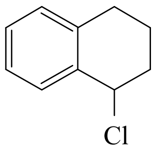
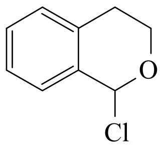
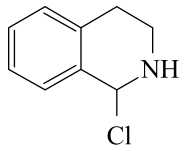
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

71. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

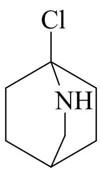
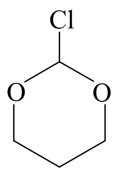
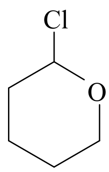
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

72. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

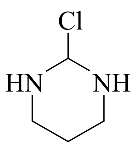
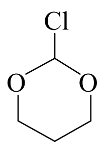
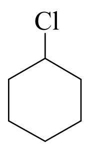
(a) i > ii > iii (b) iii > ii > i (c) i > iii > ii (d) iii > i > ii

73. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

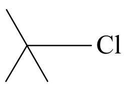
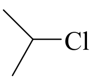
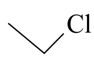
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

74. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

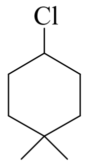
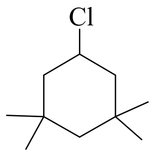
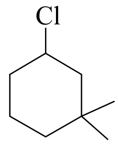
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

75. Identify correct reactivity order for S_N2 reaction

(i)  (ii)  (iii) 

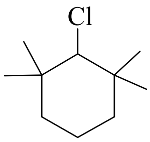
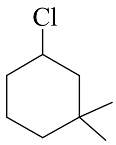
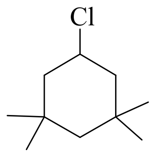
(a) iii > ii > i (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

76. Identify correct reactivity order for S_N2 reaction

(i)  (ii)  (iii) 

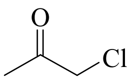
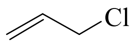
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

77. Identify correct reactivity order for S_N2 reaction

(i)  (ii)  (iii) 

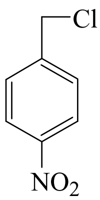
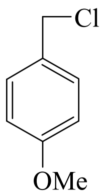
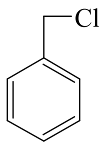
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

78. Identify correct reactivity order for S_N2 reaction

(i)  (ii)  iii $H_3C—CH_2—Cl$

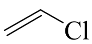
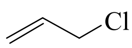
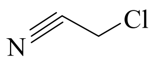
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

79. Identify correct reactivity order for S_N2 reaction

(i)  (ii)  (iii) 

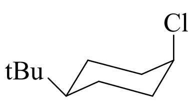
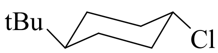
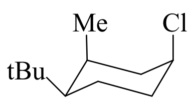
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

80. Identify correct reactivity order for S_N2 reaction

(i)  (ii)  (iii) 

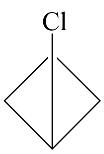
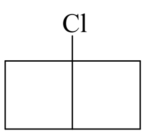
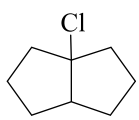
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > ii > i

81. Identify correct reactivity order for S_N2 reaction

(i)  (ii)  (iii) 

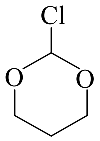
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

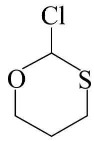
82. Identify correct reactivity order for S_N2 reaction

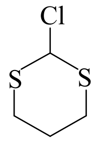
(i)  (ii)  (iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > ii > i

83. Identify correct reactivity order for S_N2 reaction

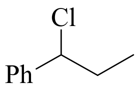
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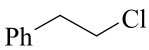
(ii) 

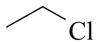
(iii) 

(a) iii > ii > i (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

84. Identify correct reactivity order for E_2 reaction with alcoholic KOH

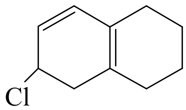
(i) 

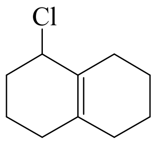
(ii) 

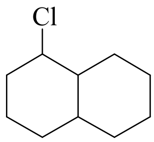
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

85. Identify correct reactivity order for E_2 reaction with alcoholic KOH

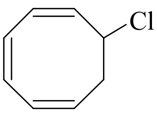
(i) 

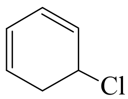
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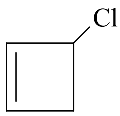
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

86. Identify correct reactivity order for E_2 reaction with alcoholic KOH

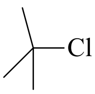
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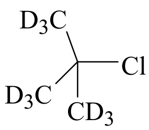
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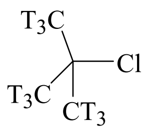
(iii) 

(a) i > ii > iii (b) ii > i > iii (c) i > iii > ii (d) iii > i > ii

87. Identify correct reactivity order for E_2 reaction with alcoholic KOH

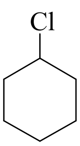
(i) 

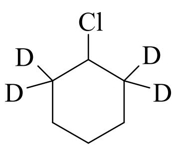
(ii) 

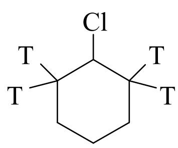
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

88. Identify correct reactivity order for E_2 reaction with alcoholic KOH

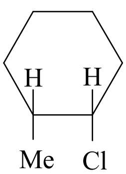
(i) 

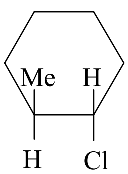
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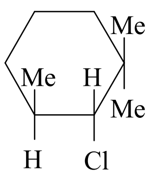
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

89. Identify correct reactivity order for E_2 reaction with alcoholic KOH

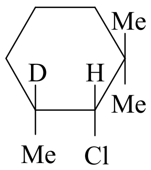
(i) 

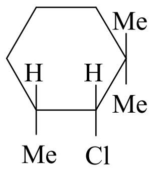
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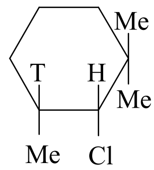
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

90. Identify correct reactivity order for E_2 reaction with alcoholic KOH

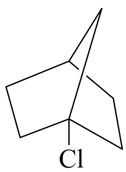
(i) 

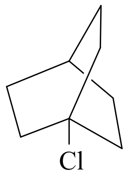
(ii) 

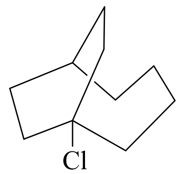
(iii) 

(a) i > ii > iii
(b) ii > i > iii
(c) i > iii > ii
(d) iii > i > ii

91. Identify correct reactivity order for E_2 reaction with alcoholic KOH

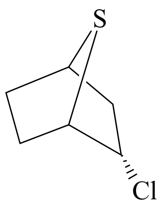
(i) 

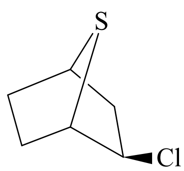
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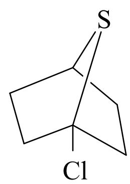
(iii) 

(a) i > ii > iii
(b) ii > iii > i
(c) i > iii > ii
(d) iii > ii > i

92. Identify rate of sololysis or hydrolysis

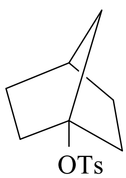
(i) 

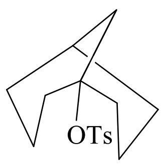
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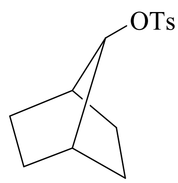
(iii) 

(a) i > ii > iii
(b) ii > iii > i
(c) i > iii > ii
(d) iii > i > ii

93. Identify rate of sololysis or hydrolysis

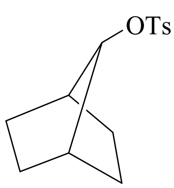
(i) 

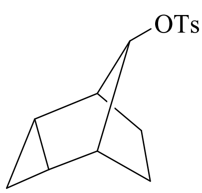
(ii) 

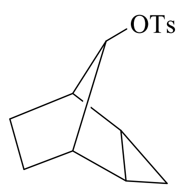
(iii) 

(a) i > ii > iii
(b) ii > iii > i
(c) i > iii > ii
(d) iii > ii > i

94. Identify rate of sololysis or hydrolysis

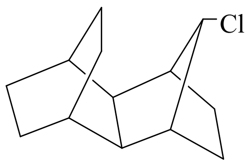
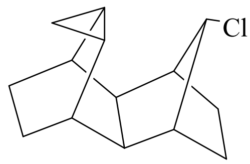
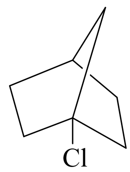
(i) 

(ii) 

(iii) 

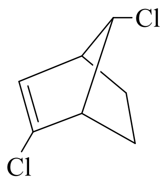
(a) i > ii > iii
(b) ii > iii > i
(c) i > iii > ii
(d) iii > i > ii

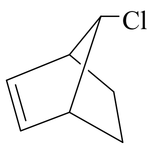
95. Identify rate of sololysis or hydrolysis

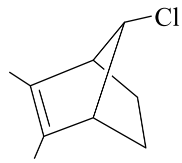
(i)  (ii)  (iii) 

(a) i > ii > iii (b) ii > iii > i (c) ii > i > iii (d) iii > i > ii

96. Identify rate of sololysis or hydrolysis

(i) 

(ii) 

(iii) 

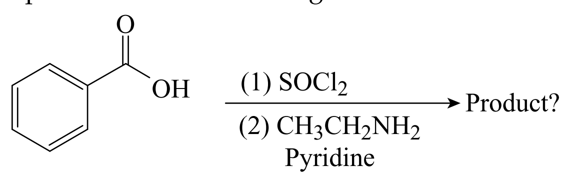
(a) iii > ii > i (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

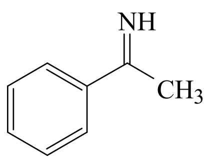
97. Which statements are true for S_N1 reaction of alkyl halides?

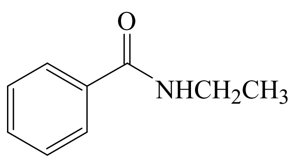
(i) Both of the alkyl halide and nucleophile are involved in the transition state.
(ii) Reaction proceeds with inversion of configuration at the substitution centre.
(iii) Reaction proceeds via the formation of carbocation intermediate.
(iv) The order of reactivity is 3° > 2° > 1°.
(v) The nucleophile must have an unshared electron pair and bear a negative charge.
(vi) Protic solvents favour S_N1 reaction.

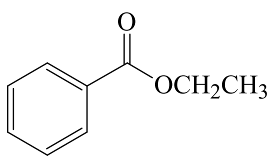
(a) iii, iv, vi (b) ii, iv, v (c) i, ii, vi (d) i, ii, v, vi

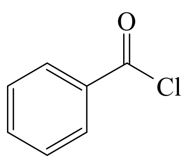
98. What could be the product for the following reaction?



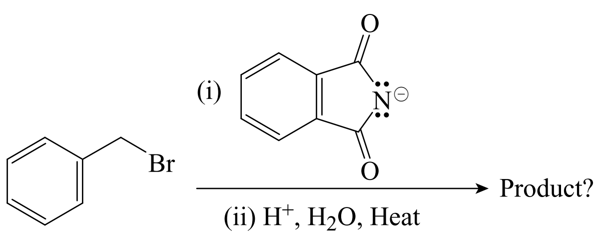
(a) 

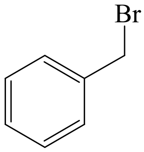
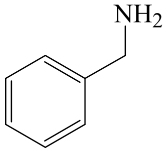
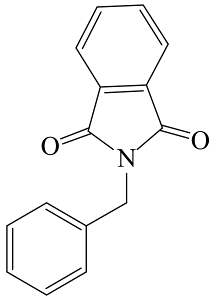
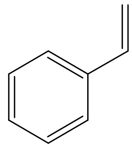
(b) 

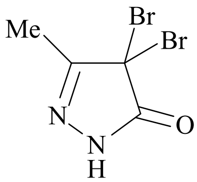
(c) 

(d) 

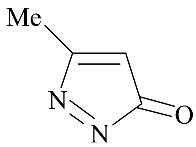
99. What could be the product for the following reaction?

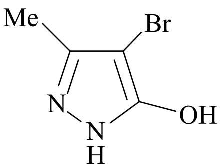


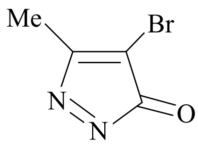
(a)  (b)  (c)  (d) 

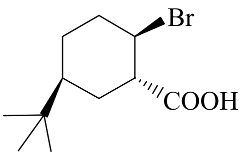
100.  $\xrightarrow[\text{(ii) HCl, } H_2O]{\text{(i) NaOH, } H_2O}$ Major product is

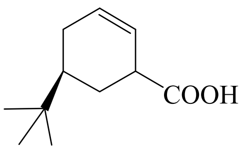
(a) Me – C ≡ C – COOH

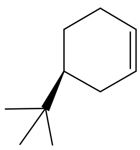
(b) 

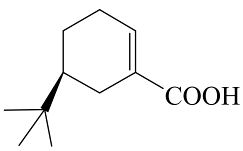
(c) 

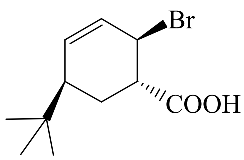
(d) 

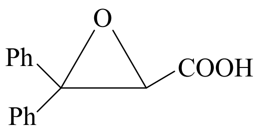
101.  $\xrightarrow[\Delta]{\text{Base}}$ Major Product?

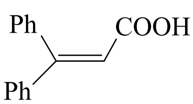
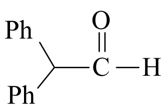
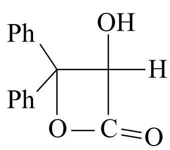
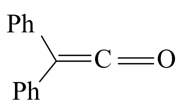
(a) 

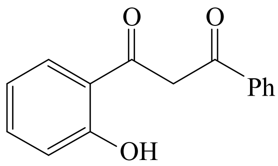
(b) 

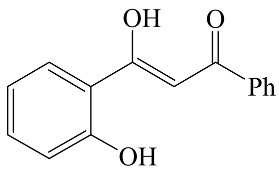
(c) 

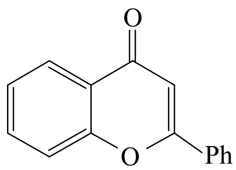
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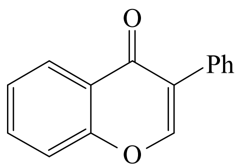
102.  $\xrightarrow{\Delta}$ Major product

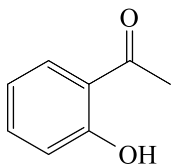
(a)  (b)  (c)  (d) 

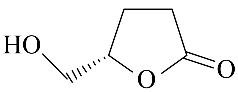
103.  $\xrightarrow{H^+}$ Major product

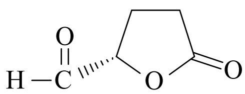
(a) 

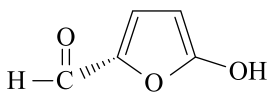
(b) 

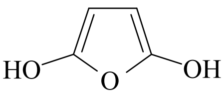
(c) 

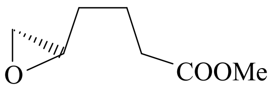
(d) 

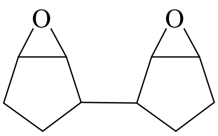
104.  $\xrightarrow[\text{(ii) } K_2CO_3, \text{ MeOH}]{\text{(i) TsCl}}$ Major product

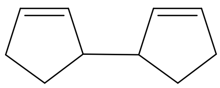
(a) 

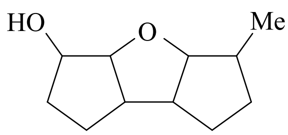
(b) 

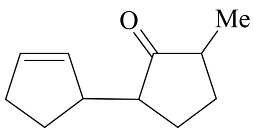
(c) 

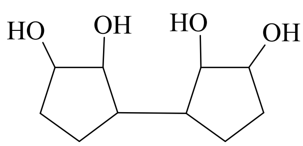
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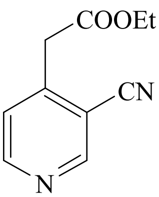
105.  $\xrightarrow[\text{(ii) } H_2O]{\text{(i) 1 eq. Me MgCl}}$ Major product

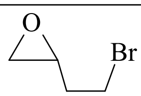
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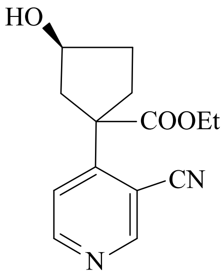
(b) 

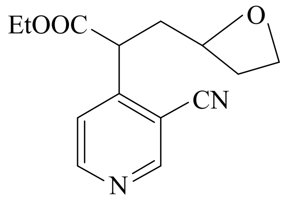
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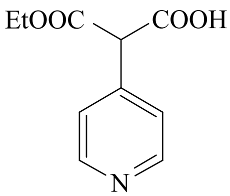
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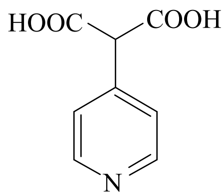
106.  $\xrightarrow{\text{(i) NaOEt}}$ Major product

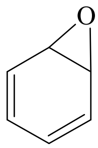
(ii) 

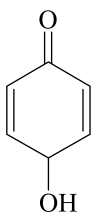
(a) 

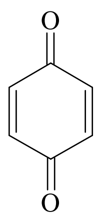
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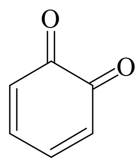
(c) 

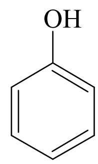
(d) 

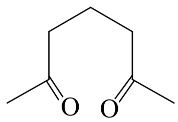
107.  $\xrightarrow{\text{Conc. } H_2SO_4}$ Major product

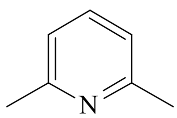
(a) 

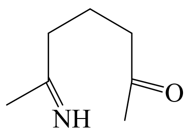
(b) 

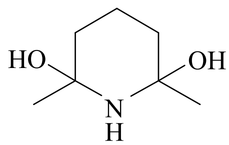
(c) 

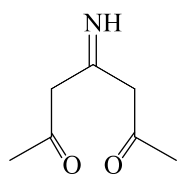
(d) 

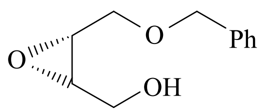
108.  $+NH_2 — OH \xrightarrow[H^+]{\Delta}$ Major product

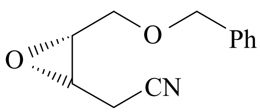
(a) 

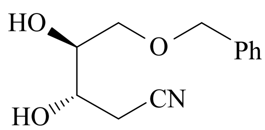
(b) 

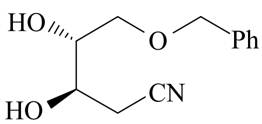
(c) 

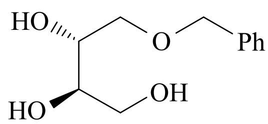
(d) 

109.  $\xrightarrow[\text{(ii) NaCN/DMSO}]{\text{(i) NaOH/}H_2O}$ Major product

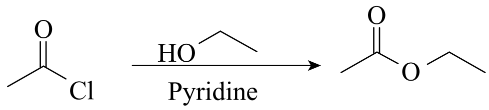
(a) 

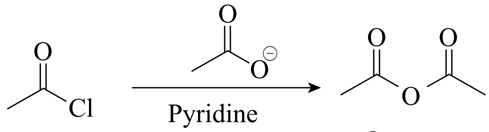
(b) 

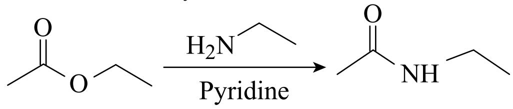
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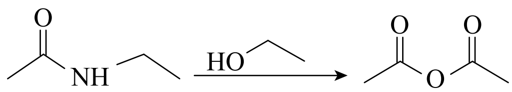
(d) 

110. Four of the five reactions shown below should proceed as shown to give good yields. One of reaction has problems and will not proceed as indicated. Identify this one reaction which will not proceed as shown.

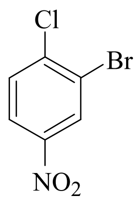
(a) 

(b) 

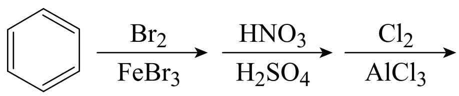
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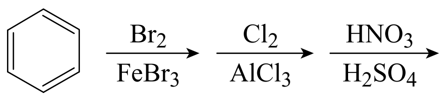
(d) 

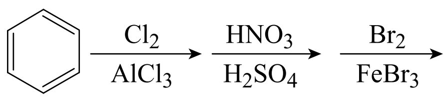
111. Which of the following synthetic schemes would be the best for the synthesis of the compound, 2-bromo-1-chloro-4-nitrobenzene?

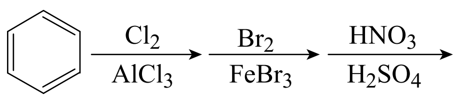


2-bromo-1-chloro-4-nitrobenzene

(a) 

(b) 

(c) 

(d) 

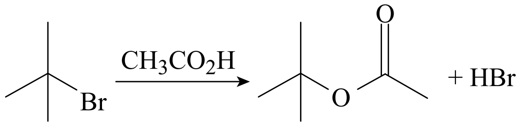
112. Which reaction is faster (i) or (ii) and what is its mechanism?

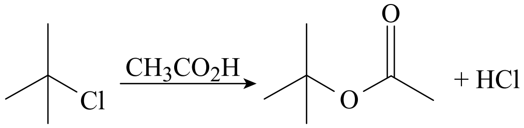
(i) 

(ii) 

(a) reaction i, S_N1
(b) reaction ii, S_N2
(c) reaction ii, S_N1
(d) reaction i, S_N2

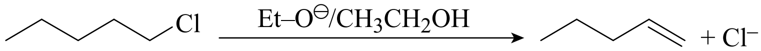
113. Which reaction is faster (i) or (ii) and what is its mechanism?

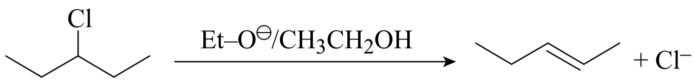
(i) 

(ii) 

(a) reaction ii, S_N1
(b) reaction ii, S_N2
(c) reaction i, S_N1
(d) reaction i, S_N2

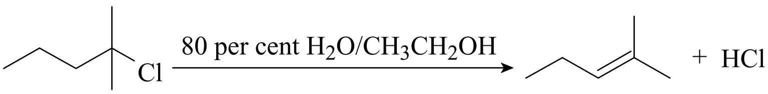
114. Which reaction is faster (i) or (ii) and what is its mechanism?

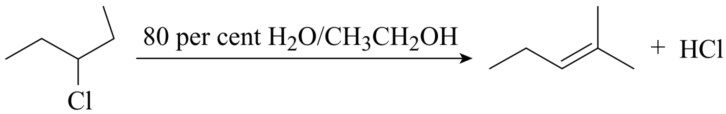
(i) 

(ii) 

(a) reaction ii, E2
(b) reaction i, E2
(c) reaction i, E1
(d) reaction ii, E1

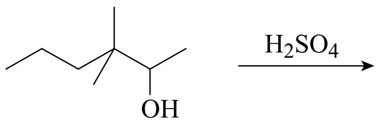
115. Which reaction is faster (i) or (ii) and what is its mechanism?

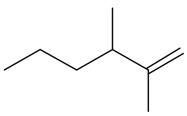
(i) 

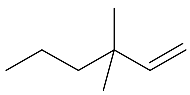
(ii) 

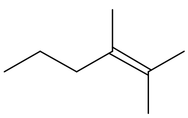
(a) reaction ii, E1
(b) reaction i, E2
(c) reaction ii, E2
(d) reaction i, E1

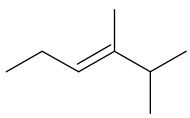
116. Predict the major product of the following reaction.



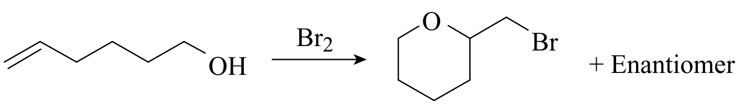
(a) 

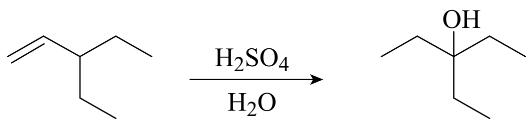
(b) 

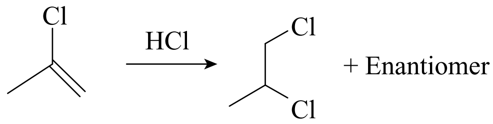
(c) 

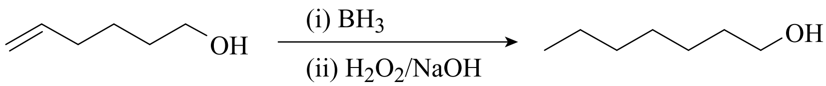
(d) 

117. Which ONE of the following reactions is NOT correct?

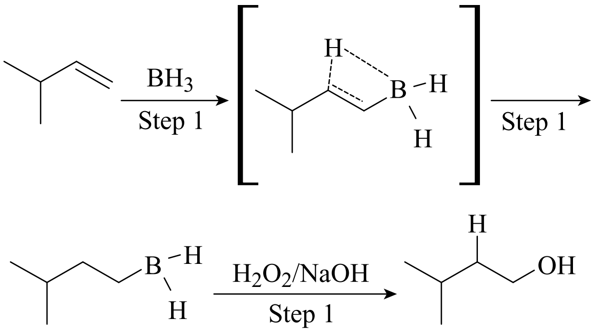
(a) 

(b) 

(c) 

(d) 

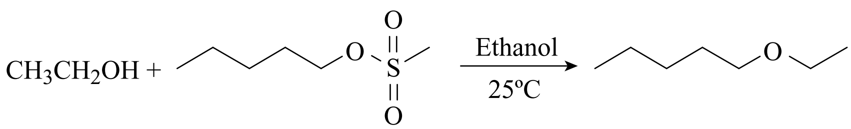
118. Consider the following reaction.

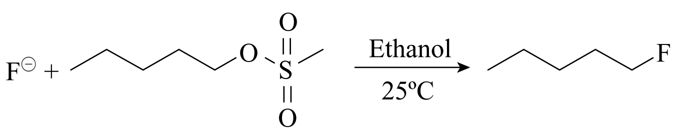


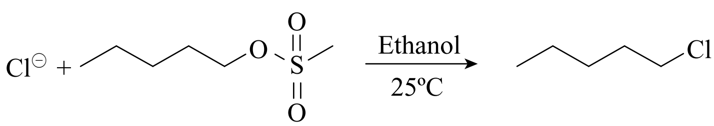
Which ONE of the following statements is INCORRECT?

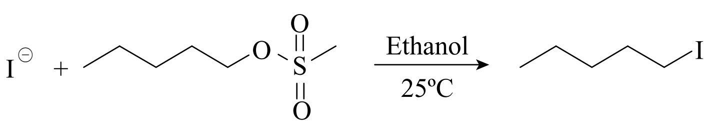
(a) In step 1, the boron atom acts as a Lewis base.
(b) In step 2, the boron atom is oxidized by hydrogen peroxide.
(c) The borane addition occurs with syn-stereospecificity.
(d) In step 1, a hydride is added at carbon 2.

119. Which one of the following five S_N2 reactions will take place most rapidly?

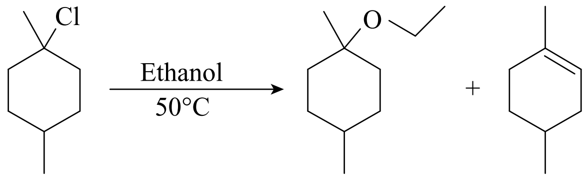
(a) 

(b) 

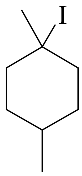
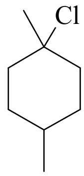
(c) 

(d) 

120. Which of the following changes will increase the rate of elimination reaction in the following reaction?

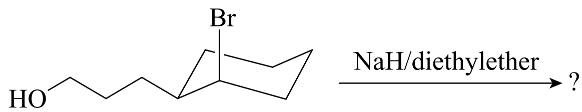


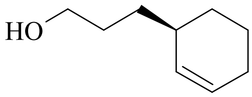
(i) using 100°C instead of 50°C (ii) using water instead of ethanol

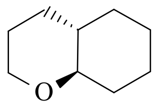
(iii) adding ethoxide to the ethanol (iv) using  instead of 

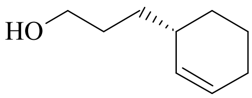
(a) i and ii (b) ii and iii (c) i, iii and iv (d) iii and iv

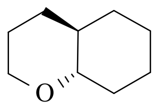
121. Which one of the following is the major product of the reaction below?



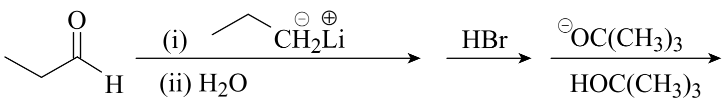
(a) 

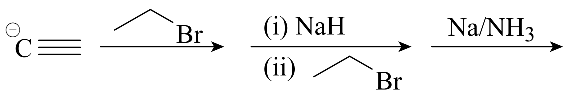
(b) 

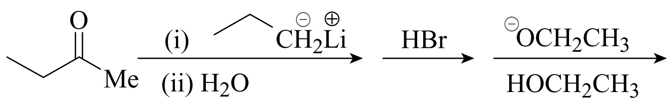
(c) 

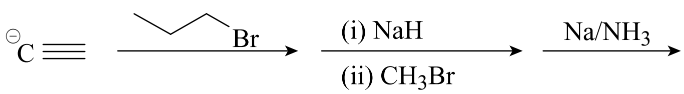
(d) 

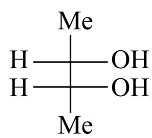
122. Which one of the sequences below is the best synthesis of (E)-3-hexene?

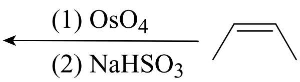
(a) 

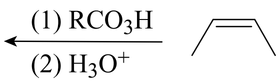
(b) 

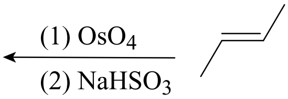
(c) 

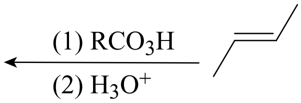
(d) 

123. Which reactions will provide the following diol as the major product  ?

(i) 

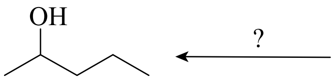
(ii) 

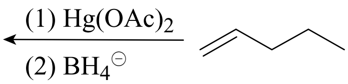
(iii) 

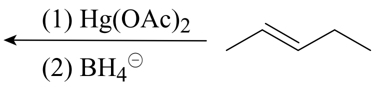
(iv) 

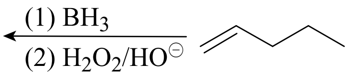
(a) i (b) iii (c) ii and iii (d) i and iv

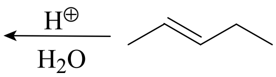
124. Which is the best synthesis of the following alcohol?



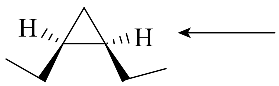
(a) 

(b) 

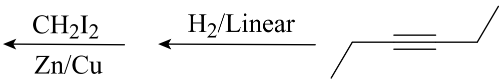
(c) 

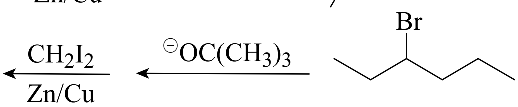
(d) 

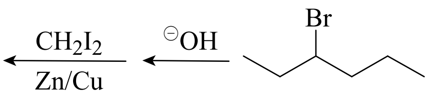
125. Which is the best synthesis of the following cyclopropane?



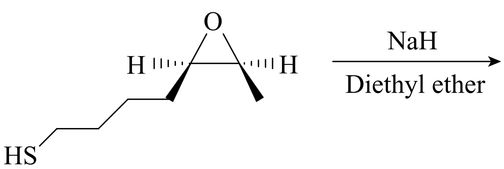
(a) 

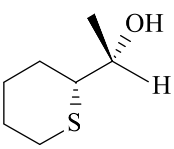
(b) 

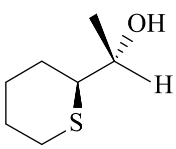
(c) 

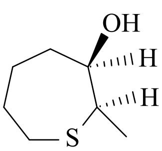
(d) 

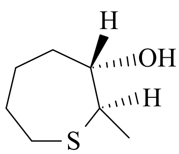
126. Which is the correct product of the following reaction?



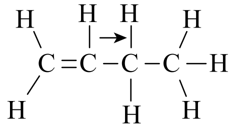
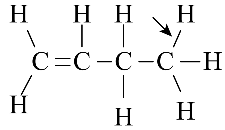
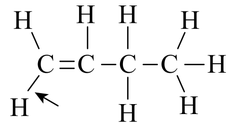
(a) 

(b) 

(c) 

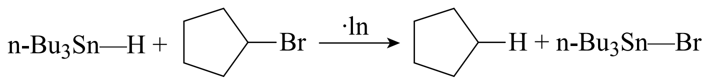
(d) 

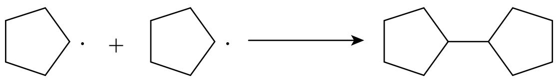
127. Arrange the indicated C—H bonds in order of increasing reactivity towards chlorination.

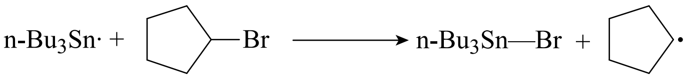
(i)  (ii)  (iii) 

(a) (ii) < (i) < (iii) $\xrightarrow[\text{reactivity}]{\text{Increasing}}$ (b) (i) < (ii) < (iii) $\xrightarrow[\text{reactivity}]{\text{Increasing}}$ (c) (ii) < (iii) < (i) $\xrightarrow[\text{reactivity}]{\text{Increasing}}$ (d) (i) < (iii) < (ii) $\xrightarrow[\text{reactivity}]{\text{Increasing}}$

128. Choose those reaction(s) that is (are) the propagation step(s) in the following free radical chain reaction.



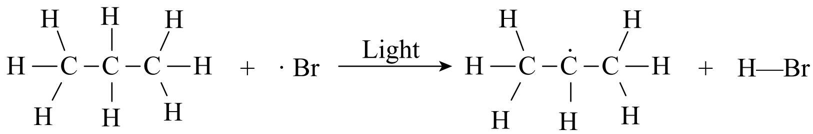
(i) 

(ii) 

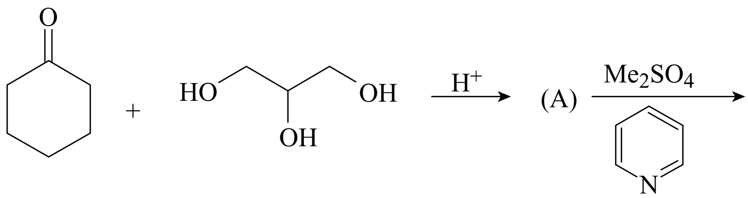
(iii) n-Bu_3Sn—H + ·ln ⟶ n-Bu_3Sn·+ H—ln

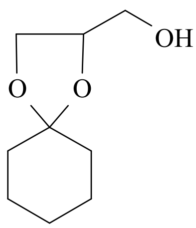
(a) i (b) ii (c) iii (d) i and ii

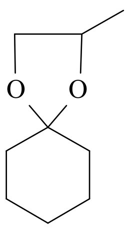
129. Choose the answer that is correct for the ΔH°(kJ/mole) of the following step in the bromination of propane.

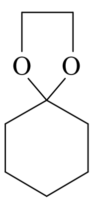


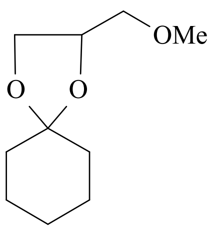
(a) Exothermic (b) Endothermic (c) Reversible (d) Irreversible

130.  'B' product is

(a) 

(b) 

(c) 

(d) 

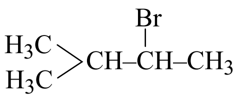
LEVEL 2

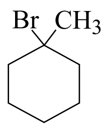
Single and Multiple-choice Type

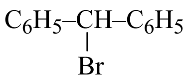
1. Which of the following shows greater reactivity towards S_N2 reaction than $CH_3—CH_2Br$ with sodium methoxide?

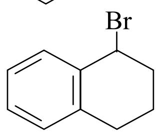
(a) $CH_3–O–CH_2Br$
(b) CH_3Br
(c) $CH_2=CH–Br$
(d) $CH_2=CH–CH_2Br$

2. Consider the S_N1 solvolysis of the following halides in aqueous formic acid?

(i) 

(ii) 

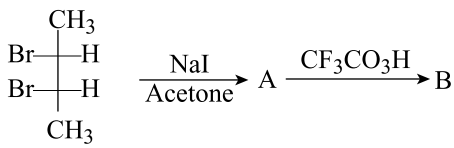
(iii) 

(iv) 

Which one of the following is correct sequence of the halides, given above, in the decreasing order of their reactivity?

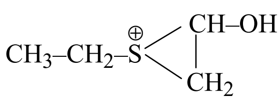
(a) iii > iv > ii > i
(b) ii > iv > i > iii
(c) i > ii > iii > iv
(d) iii > i > ii > iv

3. The correct statement for the given reaction is



(a) B is optically inactive due to external compensation
(b) B is optically inactive due to internal compensation
(c) A is predominantely cis-alkene
(d) B does not have chiral centres

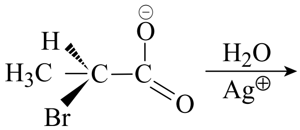
4. $CH_3–CH_2SH \xrightarrow[\text{(ii) Ethylene oxide (iii) } H_2O]{\text{(i) Dil. } \overset{\ominus}{O}H}$ Product, product is

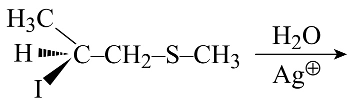
(a) $CH_3–CH_2–S–CH_2–CH_2–OH$
(b) $CH_3–CH_2O^-$
(c) $CH_3–CH_2–O–CH_2–CH_2–OH$
(d) 

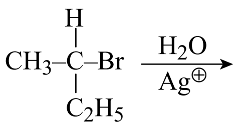
5. Which of the following statements are correct?

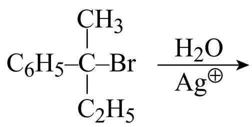
(a) The S_N1 reaction obeys the Ist order kinetics
(b) The solvolysis of ethylbromide in ethanoic solution is first order kinetics
(c) R configuration of a compound may result in R and S configurations in an S_N2 reaction
(d) 1-Bromo-1-phenylethane shows greater reactivity towards S_N1 and S_N2 reaction compared to isopropyl bromide

6. Which of the following reactions will proceed with retention of configuration only (no inversion) at the chiral carbon?

(a) 

(b) 

(c) 

(d) 

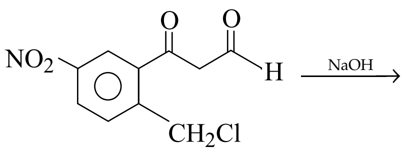
7. Correct statements is

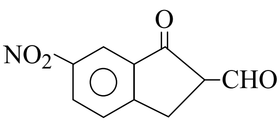
(a) Nucleophilicity of $\overset{\ominus}{S}H$ is greater than $\overset{\ominus}{O}H$ in dimethyl formamide

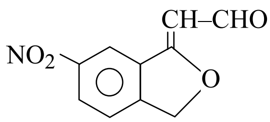
(b) Hydrazine is a better nucleophile than NH_3

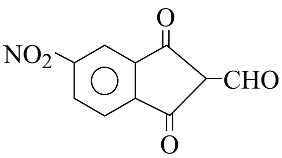
(c) Phenoxide ion is more basic than acetate ion

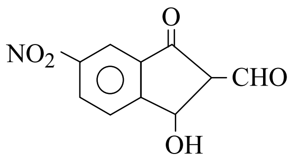
(d) $\overset{\ominus}{C}H_3$ is a better nucleophile than $\overset{\ominus}{O}H$ in a non-polar solvent

8.  A, A can be

(a) 

(b) 

(c) 

(c) 

9. Identify the compounds that will undergo substitution reaction faster than C_2H_5Br with OH^-/DMSO.

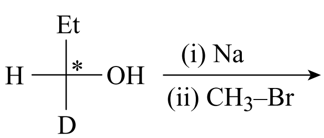
(a) CH_3CH_2–S–CH_2CH_2Br

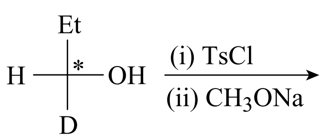
(b) CH_3–CH_2CH_2Br

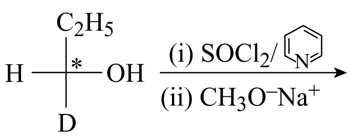
(c) CH_3—CH(Br)—C(=O)$O^{\ominus}$

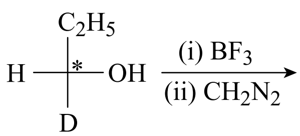
(d) CH_3–CH(Br)–CH_3

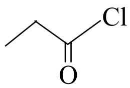
10. In which of the following cases, the configuration of chiral C is retained in product?

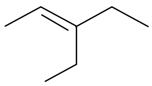
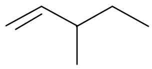
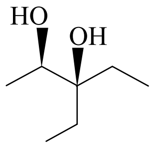
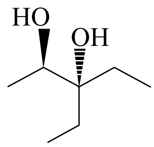
(a) 

(b) 

(c) 

(d) 

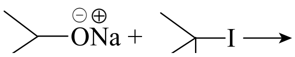
11.  $\xrightarrow[\text{H}_3\text{O}^+]{\text{(excess) EtMgBr}}$ (A) $\xrightarrow[\Delta]{\text{H}_2\text{SO}_4}$ (B) $\xrightarrow[\text{(ii) H}_3\text{O}^+]{\text{(i) Br}_2/\text{H}_2\text{O/NaOH}}$ (C); Products B and C are

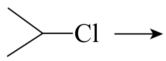
(a)  (b)  (c)  (d) 

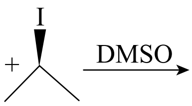
12. Which statement is/are correct in the following statements?

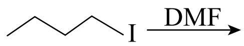
(a) Allyl bromide gives S_N1 reaction but vinyl chloride does not.
(b) Primary alkyl halides can give S_N1 or S_N2 reaction. This depends on the structure of the substrate and nature of solvent.
(c) CH_3–CH=CH–CH_2Cl reacts with KCN to give mixture of two isomeric products.
(d) CH_3–CH_2–O–CH_2Br is less reactive than tert. butyl bromide for S_N1 reaction.

13. Identify reaction that follows S_N2 path

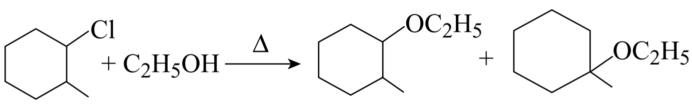
(a) 

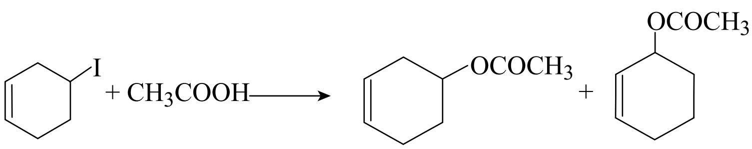
(b) NaI/Acetone + 

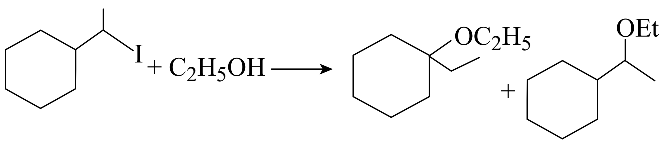
(c) NaSH + 

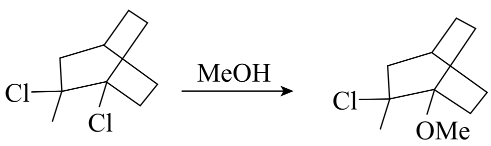
(d) NaN_3 + 

14. Which of the reactions give the correct product?

(a)  (possible product)

(b)  (possible product)

(c)  (possible product)

(d)  (major product)

15. Which of the following alcohol gives the white turbidity immediately with HCl + $ZnCl_2$ (anhy.)?

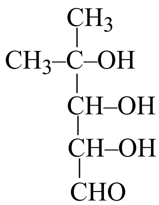
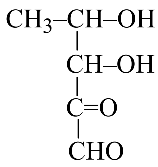
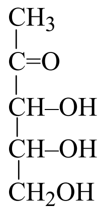
(a) CH_3—C(Ph)(OH)—OC_2H_5

(b) Ph—CH(OH)—CH_3

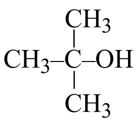
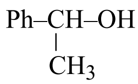
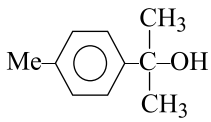
(c) Ph—CH(OH)—CH=CH_2

(d) CH_3–CH_2CH_2OH

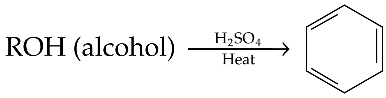
16. A $\xrightarrow{HIO_4}$ $CH_3CHO + 2HCOOH + CH_3COOH$. The structure of A is

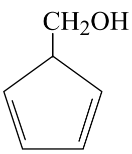
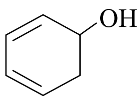
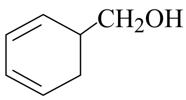
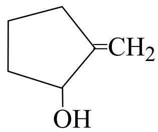
(a)  (b)  (c)  (d) none of these

17. Which of the following gives turbidity immediately with Lucas-reagent (anhy. $ZnCl_2$ + HCl)?

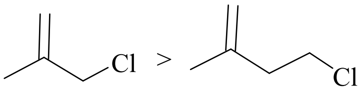
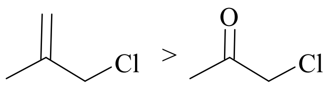
(a)  (b)  (c)  (d) CH_3CH_2OH

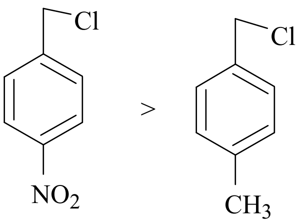
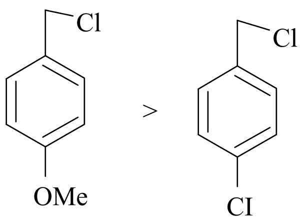
18. The possible structure of the alcohol is



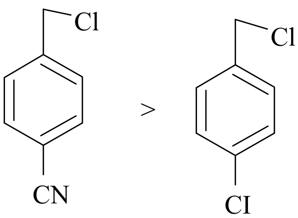
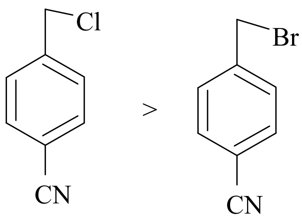
(a)  (b)  (c)  (d) 

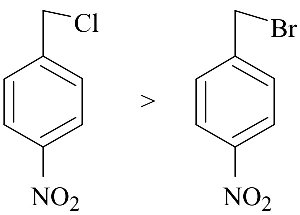
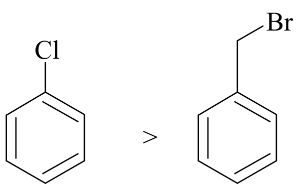
19. Identify correct reactivity order for S_N2 reaction

(a)  (b) 

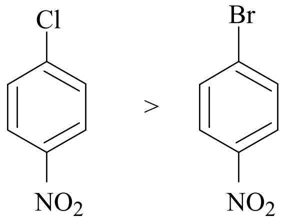
(c)  (d) 

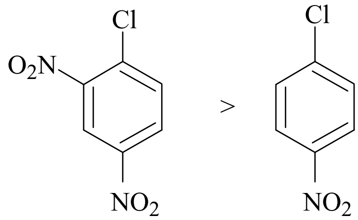
20. Identify correct reactivity order for S_N2 reaction

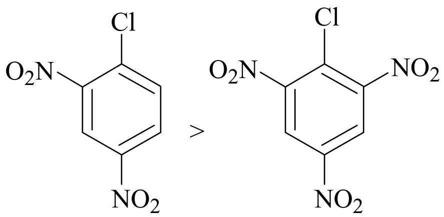
(a)  (b) 

(c)  (d) 

21. Identify correct reactivity order for ArSN reaction

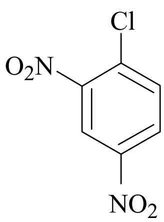
(a) 

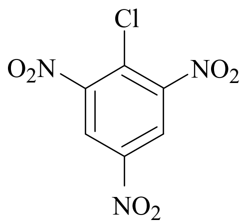
(b) 

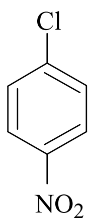
(c) 

(d) (a) and (b) are correct

22. Identify correct reactivity order for ArSN reaction

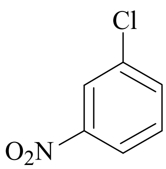
(i) 

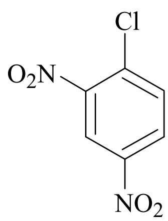
(ii) 

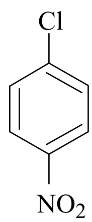
(iii) 

(a) i > ii > iii
(b) ii > i > iii
(c) i > iii > ii
(d) iii > i > ii

23. Identify correct reactivity order for ArSN reaction

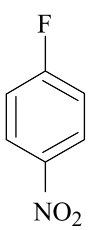
(i) 

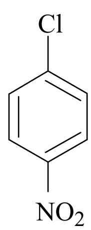
(ii) 

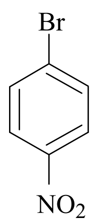
(iii) 

(a) i > ii > iii
(b) ii > iii > i
(c) i > iii > ii
(d) iii > i > ii

24. Identify correct reactivity order for ArSN reaction

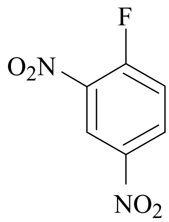
(i) 

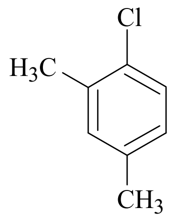
(ii) 

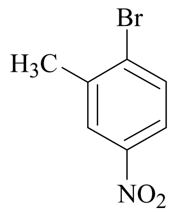
(iii) 

(a) i > ii > iii
(b) ii > iii > i
(c) i > iii > ii
(d) iii > i > ii

25. Identify correct reactivity order for ArSN reaction

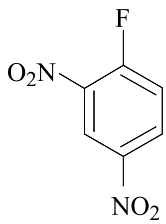
(i) 

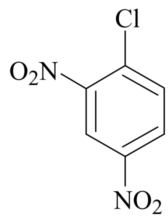
(ii) 

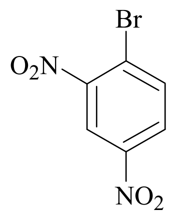
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

26. Identify correct reactivity order for ArSN reaction

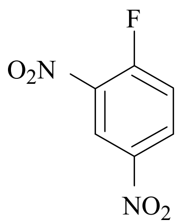
(i) 

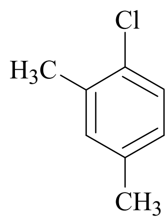
(ii) 

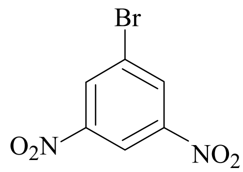
(iii) 

(a) i > ii > iii (b) ii > iii > i
(c) i > iii > ii (d) iii > i > ii

27. Identify correct reactivity order for ArSN reaction

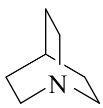
(i) 

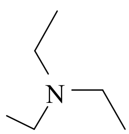
(ii) 

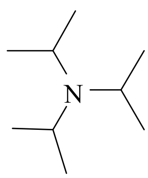
(iii) 

(a) i > ii > iii (b) ii > iii > i
(c) i > iii > ii (d) iii > i > ii

28. Identify correct nucleophilicity order

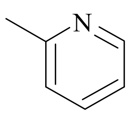
(i) 

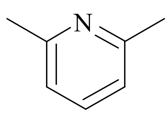
(ii) 

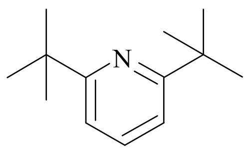
(iii) 

(a) i > ii > iii (b) ii > iii > i
(c) i > iii > ii (d) iii > i > ii

29. Identify correct nucleophilicity order

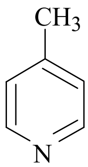
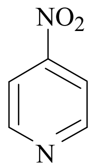
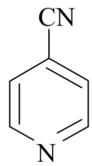
(i) 

(ii) 

(iii) 

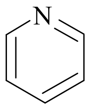
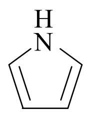
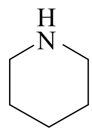
(a) i > ii > iii (b) ii > iii > i
(c) i > iii > ii (d) iii > i > ii

30. Identify correct nucleophilicity order

(i)  (ii)  (iii) 

(a) i > ii > iii (b) ii > iii > i
(c) i > iii > ii (d) iii > i > ii

31. Identify correct nucleophilicity order

(i)  (ii)  (iii) 

(a) i > ii > iii (b) ii > iii > i
(c) i > iii > ii (d) iii > i > ii

32. Identify correct nucleophilicity order

(i) H_2O (ii) H_2S (iii) H_2Se

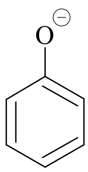
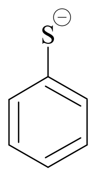
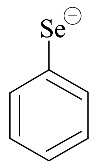
(a) i > ii > iii (b) ii > iii > i
(c) i > iii > ii (d) iii > ii > i

33. Identify correct nucleophilicity order

(i) PH_3 (ii) NH_3 (iii) AsH_3

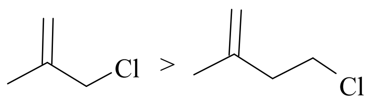
(a) i > ii > iii (b) ii > iii > i
(c) i > iii > ii (d) iii > i > ii

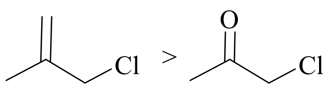
34. Identify correct nucleophilicity order

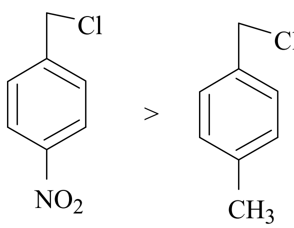
(i)  (ii)  (iii) 

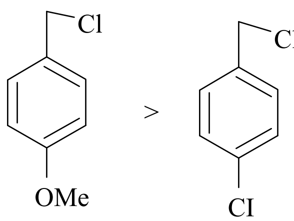
(a) i > ii > iii (b) ii > iii > i
(c) i > iii > ii (d) iii > ii > i

35. Identify correct reactivity order for S_N1 reaction

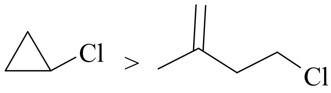
(a) 

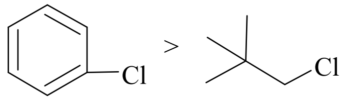
(b) 

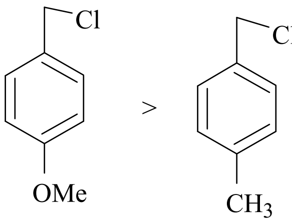
(c) 

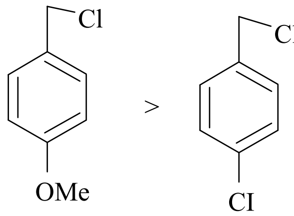
(d) 

36. Identify ccorrect reactivity order for S_N1 reaction

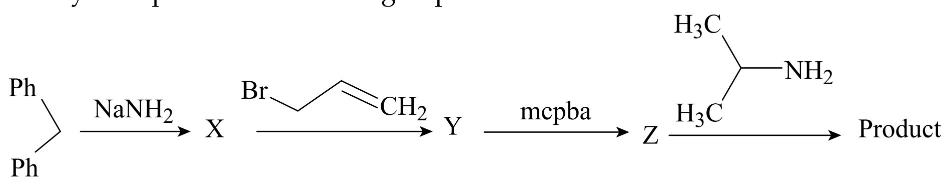
(a) 

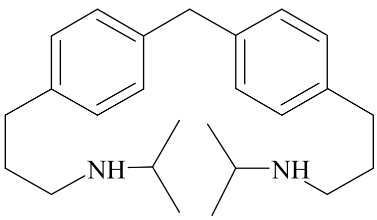
(b) 

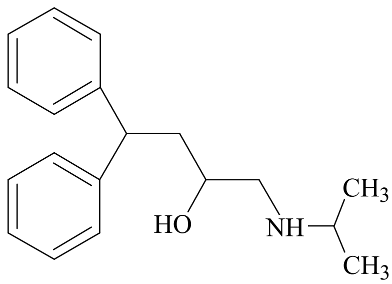
(c) 

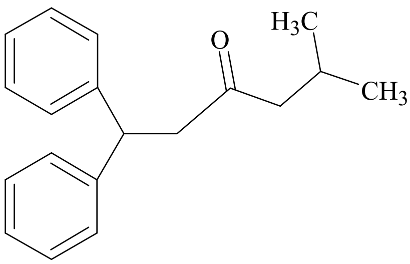
(d) 

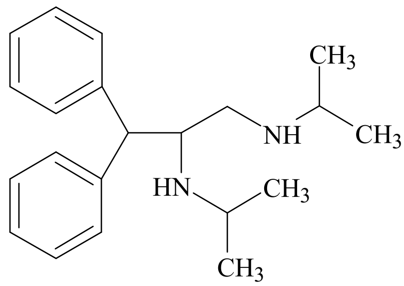
37. Identify final product in following sequence



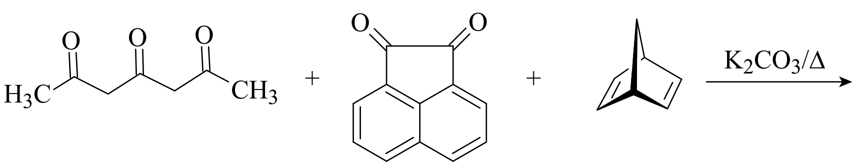
(a) 

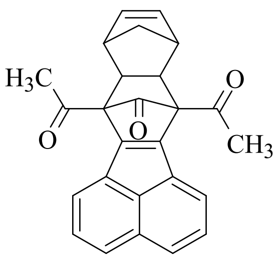
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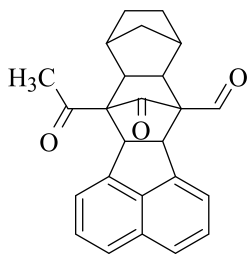
(c) 

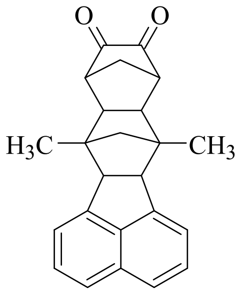
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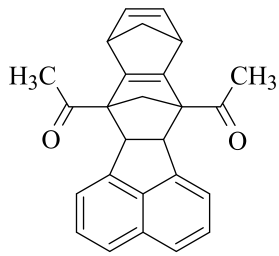
38. Identify final product of following reaction



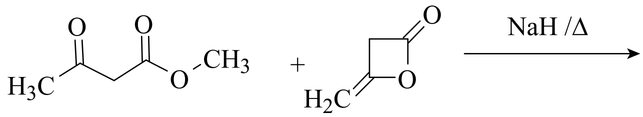
(a) 

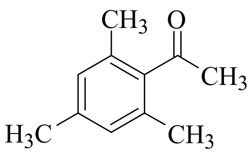
(b) 

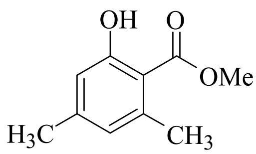
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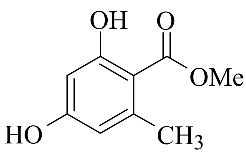
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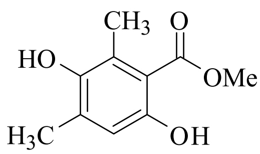
39. Identify final product of following reaction



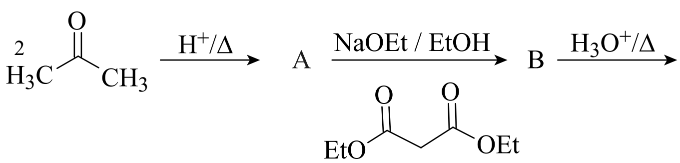
(a) 

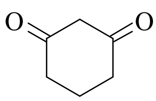
(b) 

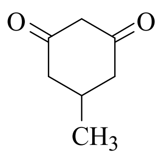
(c) 

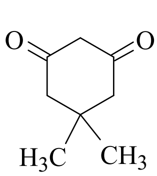
(d) 

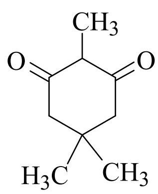
40. Identify final product of following reaction



(a) 

(b) 

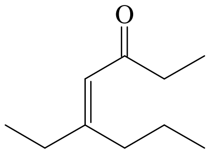
(c) 

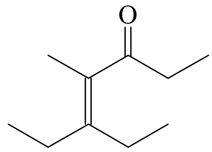
(d) 

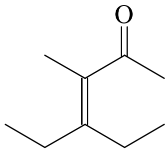
41. Select all of the following statements about the aldol experiment that are true

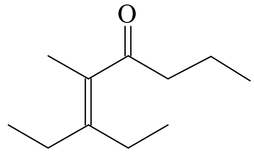
(a) The ketone was added to a solution containing the aldehyde and base.
(b) The reaction can be catalysed by acid
(c) The electrophile is the enolate ion
(d) The aldehyde is used in excess

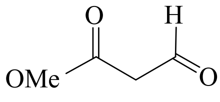
42. Which of the following structures is the product from the self-condensation of two molecules of pentan-3-one?

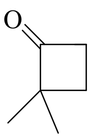
(a) 

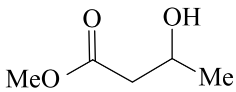
(b) 

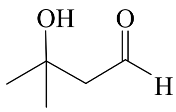
(c) 

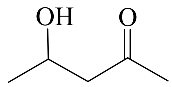
(d) 

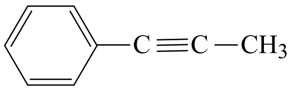
43.  i. HO–$(CH_2)_2$–OH, H^+ → ii. Excess MeMgBr, then H_3O^+

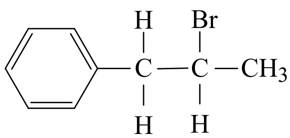
(a) 

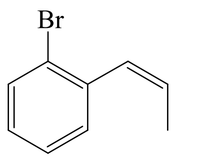
(b) 

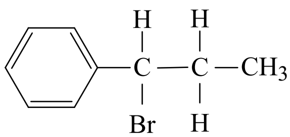
(c) 

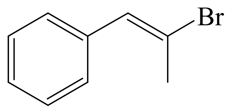
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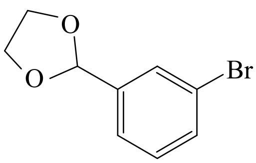
44.  (i) Na, NH_3 → (ii) HBr Product is

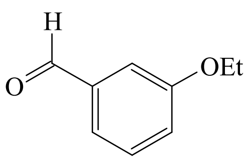
(a) 

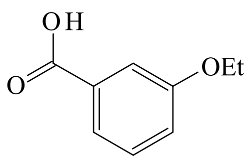
(b) 

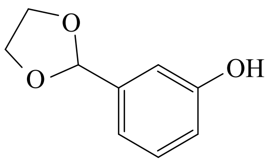
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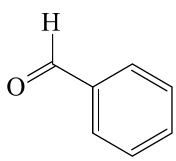
(d) 

45.  (i) Mg, Ether (ii) EtOH → (iii) Catalytic H^+, H_2O

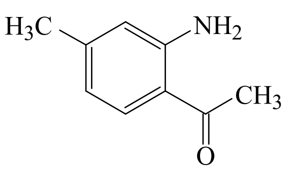
(a) 

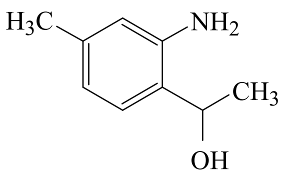
(b) 

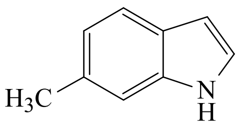
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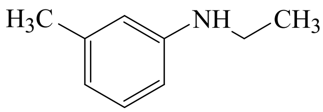
(d) 

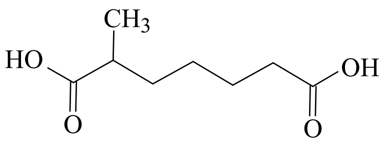
46. CH_3CO_2H $\xrightarrow[\text{(ii) 3-Methylaniline}]{\text{(i) } SOCl_2}$
(iii) $LiAlH_4$, then H_3O^+

(a) 

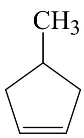
(b) 

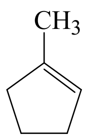
(c) 

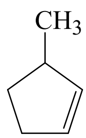
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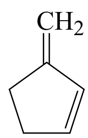
47. $\xrightarrow[\text{(ii) } NaBH_4]{\text{(i) } O_3\text{, then Zn in } H_2O}$ 

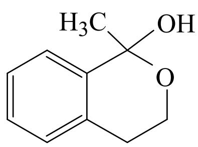
(iii) Excess PBr_3
(iv) Excess KCN
(v) H^+, H_2O and heat

(a) 

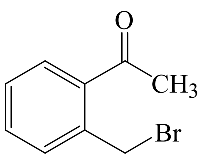
(b) 

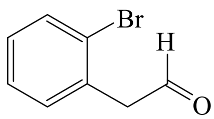
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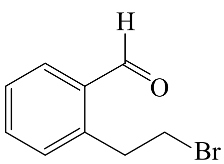
(d) 

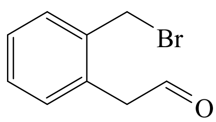
48. $\xrightarrow[\text{(ii) Mg, THF then } H_2C{=}O\text{, then } H_3O^+]{\text{(i) HO–}CH_2CH_2\text{–OH, catalytic } H^+}$ 

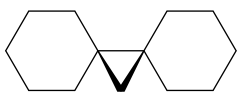
(iii) H_3O^+, heat

(a) 

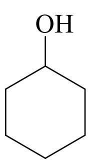
(b) 

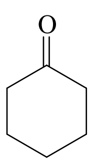
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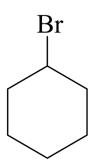
(d) 

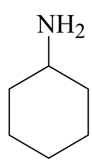
49. $\xrightarrow[\text{(ii) Cyclohexanone}]{\text{(i) } Ph_3P\text{, then n-BuLi}}$ 

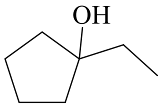
(iii) CH_2I_2, Zn–Cu

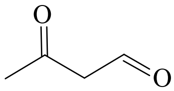
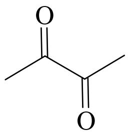
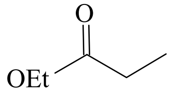
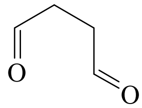
(a) 

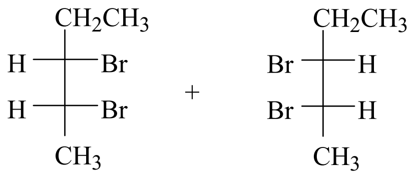
(b) 

(c) 

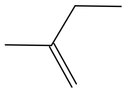
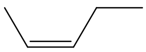
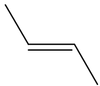
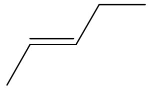
(d) 

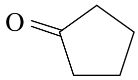
50. $\xrightarrow[\text{then } H_3O^+]{BrMg–(CH_2)_4–MgBr}$ 

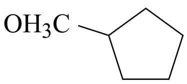
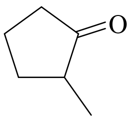
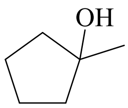
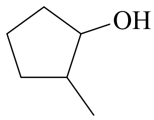
(a)  (b)  (c)  (d) 

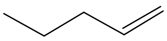
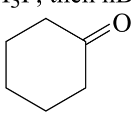
51. $\xrightarrow{Br_2}$ 

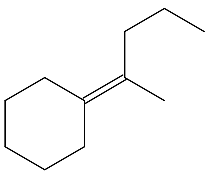
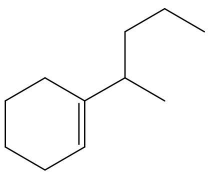
(50:50 of these enantiomers)

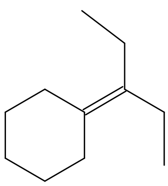
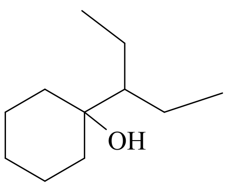
(a)  (b)  (c)  (d) 

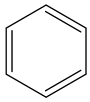
52.  $\xrightarrow{\text{(i) LDA}}$ (ii) CH_3I (iii) $NaBH_4$/MeOH

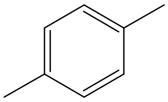
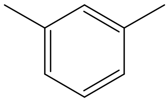
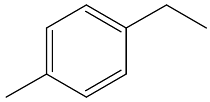
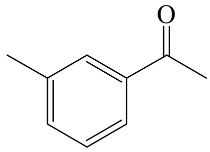
(a)  (b)  (c)  (d) 

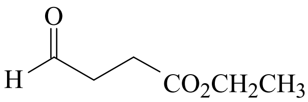
53.  $\xrightarrow{\text{(i) HBr (dark, } N_2)}$ (ii) PH_3P, then nBuLi (iii) 

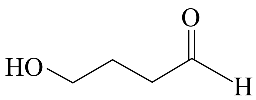
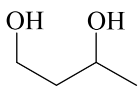
(a)  (b) 

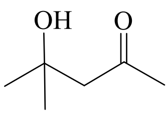
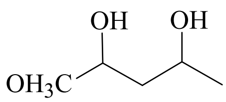
(c)  (d) 

54.  (i) $(CH_3CO)_2O/AlCl_3$ → (ii) Zn/Hg, HCl (iii) $CH_3Cl/AlCl_3$

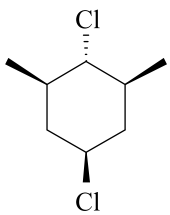
(a)  (b)  (c)  (d) 

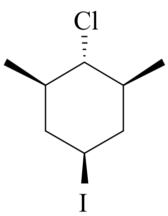
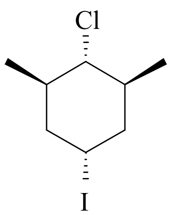
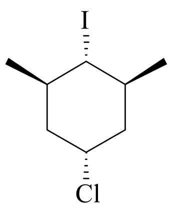
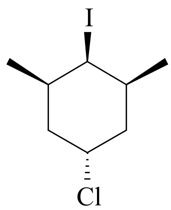
55.  (i) $HOCH_2CH_2OH/H^+$/heat → (ii) $LiAlH_4$, then H_3O^+ (iii) H_3O^+/heat

(a)  (b) 

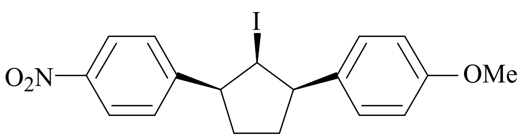
(c)  (d) 

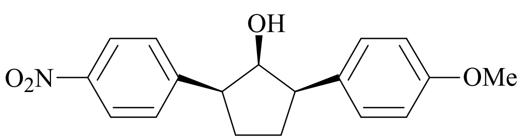
56. Identify major product for the following reaction

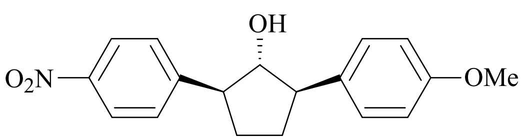
 1 eq. NaI/Acetone →

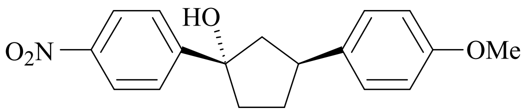
(a)  (b)  (c)  (d) 

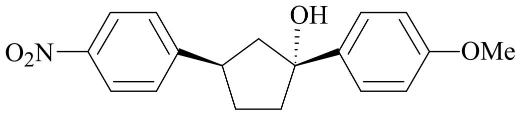
57. Identify major product for the following reaction

 Aqueous/Acetone →

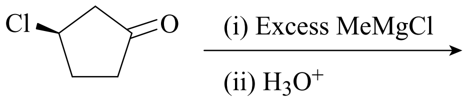
(a) 

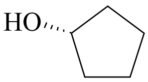
(b) 

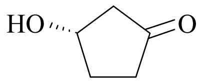
(c) 

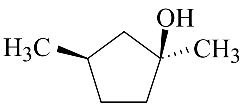
(d) 

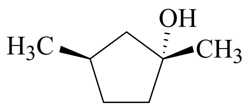
58. Identify major product for the following reaction


Major product is?

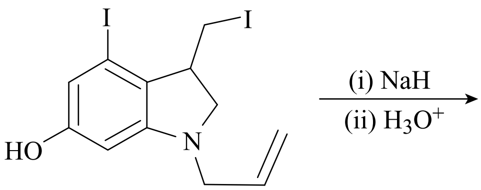
(a) 

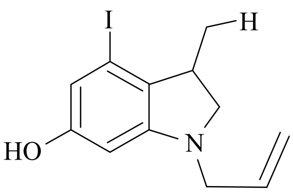
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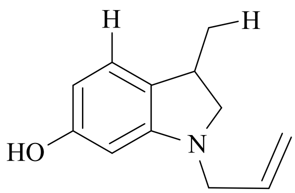
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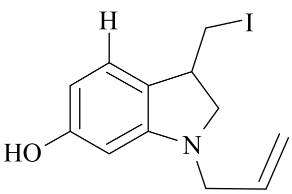
(d) 

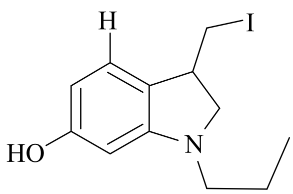
59. Identify major product for the following reaction


Major product is?

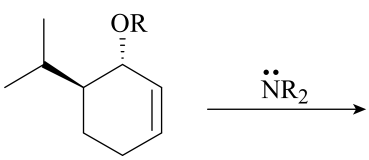
(a) 

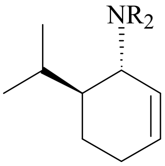
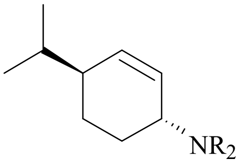
(b) 

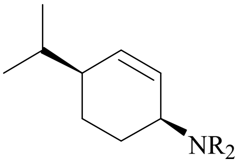
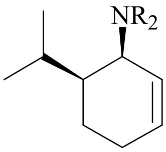
(c) 

(d) 

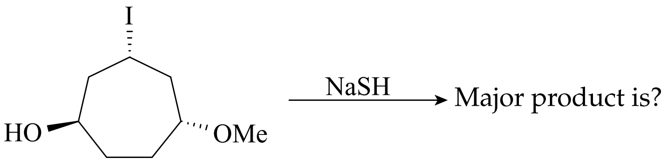
60. Identify major product for the following reaction

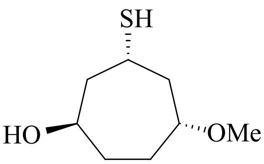
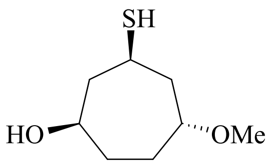

Major product is?

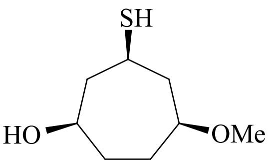
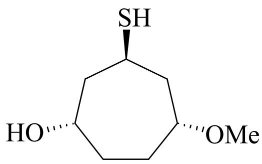
(a) 
(b) 

(c) 
(d) 

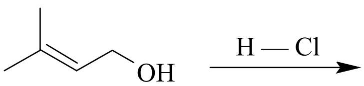
61. Identify major product for the following reaction

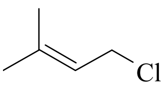
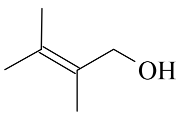
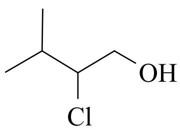
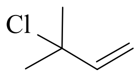


(a) 
(b) 

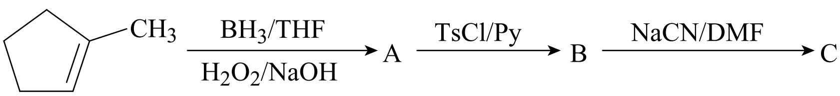
(c) 
(d) 

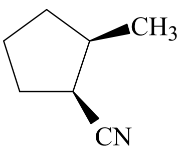
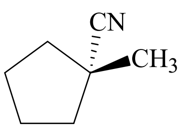
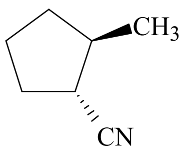
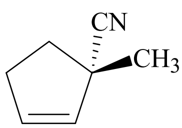
62. Choose the major product of the following reaction.



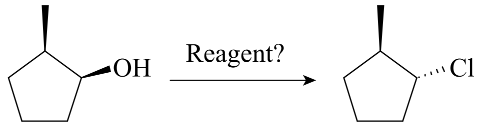
(a) 
(b) 
(c) 
(d) 

63. Identify major product of the following reaction



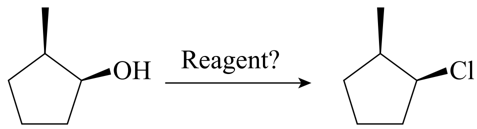
(a) 
(b) 
(c) 
(d) 

64. Identify best reagent for the following conversion



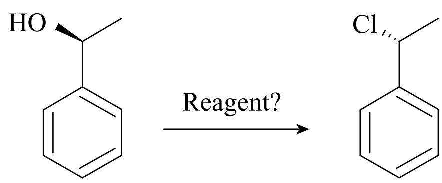
(a) $ZnCl_2/HCl$ (b) PCl_5 (c) PCl_3 (d) $SOCl_2$

65. Identify best reagent for the following conversion



(a) $ZnCl_2/HCl$ (b) PCl_5 (c) PCl_3 (d) $SOCl_2$

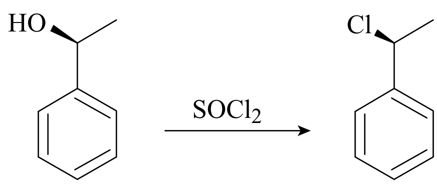
66. Identify best reagent for the following conversion



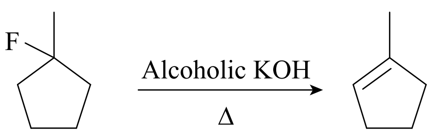
(a) $ZnCl_2/HCl$ (b) PCl_5 (c) PCl_3 (d) $SOCl_2$

67. Identify reactions that correctly match with their products

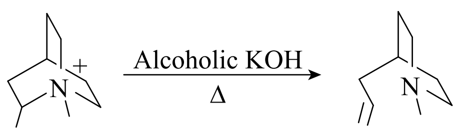
(a)



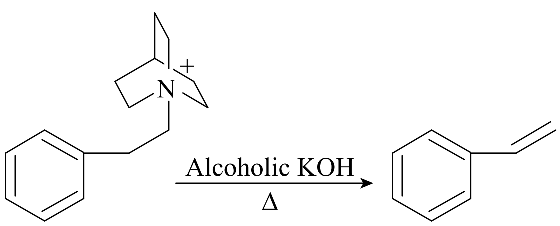
(b)



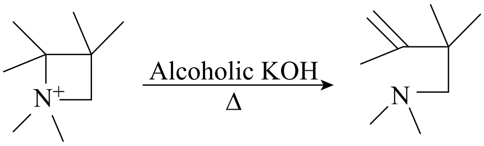
(c)

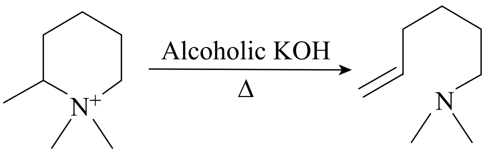


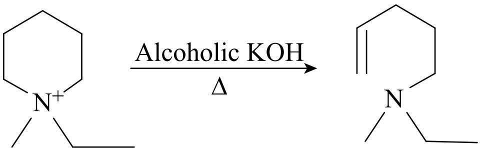
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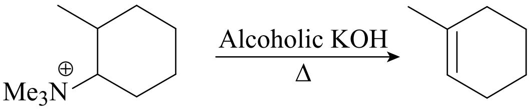


68. Identify reactions that correctly match with their products

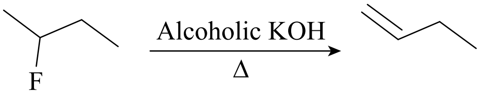
(a) 

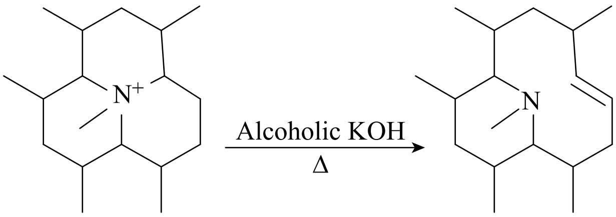
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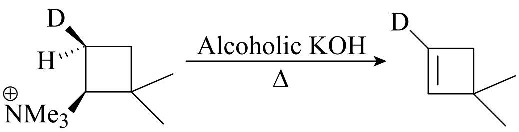
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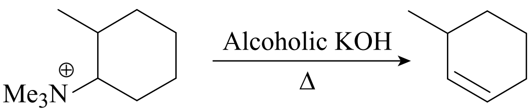
(d) 

69. Identify reactions that correctly match with their products

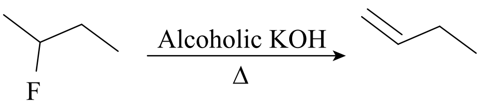
(a) 

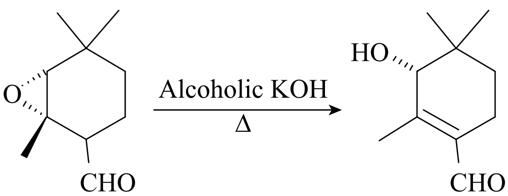
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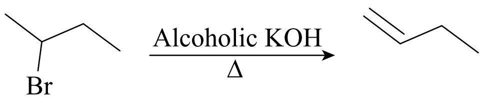
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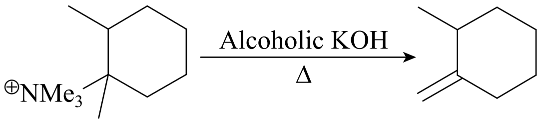
(d) 

70. Identify reactions that correctly match with their products

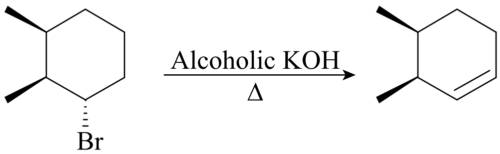
(a) 

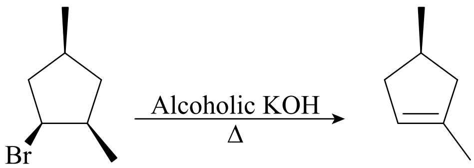
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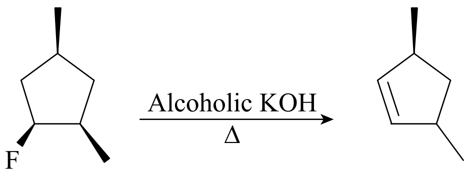
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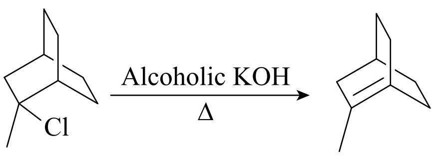
(d) 

71. Identify reactions that correctly match with their products

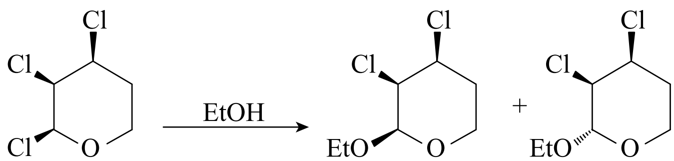
(a) 

(b) 

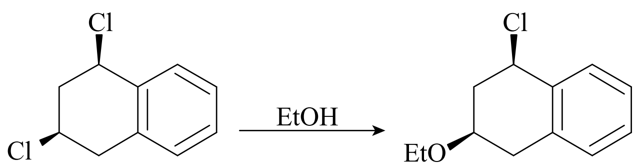
(c) 

(d) 

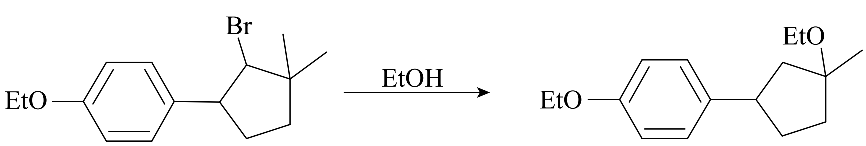
72. Identify reactions that correctly match with their products?

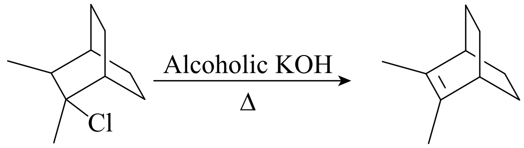
(a) 

Monosubstituted product

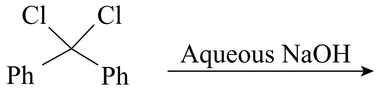
(b) 

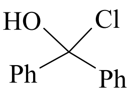
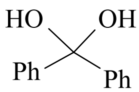
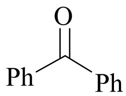
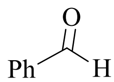
Monosubstituted product

(c) 

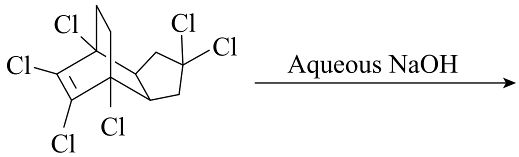
(d) 

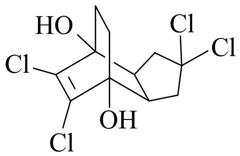
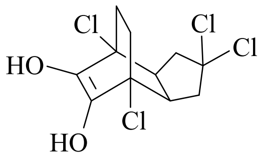
73. Identify major product for the following reaction

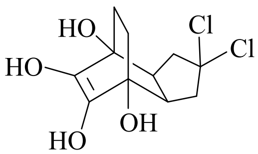
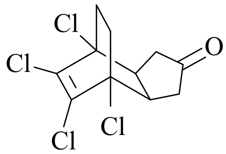
 Major product is?

(a)  (b)  (c)  (d) 

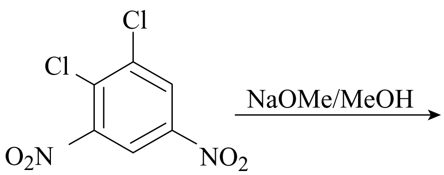
74. Identify major product for the following reaction

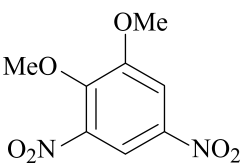
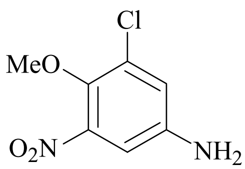
 Major product is?

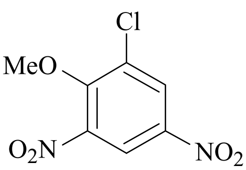
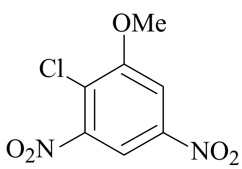
(a)  (b) 

(c)  (d) 

75. Identify major product for the following reaction

 Major product is?

(a)  (b) 

(c)  (d) 

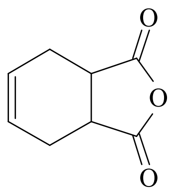
76. Identify S_N2 reaction which is favourable in a polar protic medium

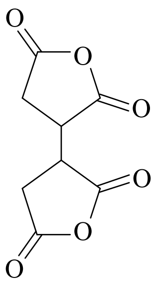
(a) $NaOH + CH_3 - I \longrightarrow HO{-}CH_3 + NaI$

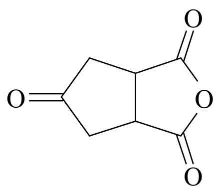
(b) $OH^- + Me - \overset{\oplus}{N}Me_3 \longrightarrow OH{-}Me + \ddot{N}Me_3$

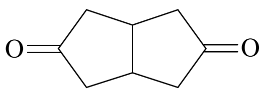
(c) $\ddot{N}H_3 + Me - \overset{\oplus}{S}Me_2 \longrightarrow H_2N - Me + SMe_2$

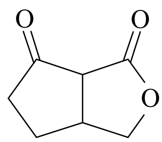
(d) $NH_3 + Me{-}I \longrightarrow H_2N - Me + H{-}I$

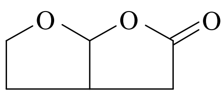
77.  $\xrightarrow[\text{(ii) Conc. } KMnO_4/\Delta \text{ (iii) } \Delta]{\text{(i) LAH}}$ Possible products

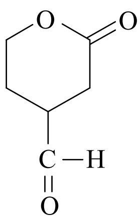
(a) 

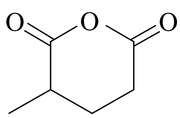
(b) 

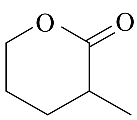
(c) 

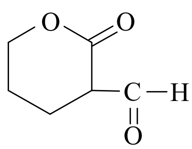
(d) 

78.  $\xrightarrow[\text{(ii) } H^+/\Delta]{\text{(i) Aq. NaOH}}$ Major product?

(a) 

(b) 

(c) 

(d) 

Comprehension Type

Passage 1

Suppose, a sample of an initially pure single enantiomer of tartaric acid $[\alpha]_D^{20} = +12.4°$ (H_2O) underwent a chemical isomerization reaction which yielded 10 per cent of the other enantiomer and 20 per cent of the meso isomer, in addition to 70 per cent of the unchanged starting compound.

79. What is the enantiomeric excess (ee.) of the major enantiomer relative to the minor enantiomer?

(a) 70 per cent (b) 700 per cent
(c) 75 per cent (d) 87.5 per cent

80. If 1.0 g of the total mixture (including the meso isomer) was dissolved in 1 mL water and the rotation measured in a 1 dm cell, what value of α_D would one expect to observe?

(a) +9.92 (b) +7.44 C (c) +12.4 (d) +8.68

81. From the total mixture, chromatographic separation on silica gel (a commonly used achiral solid adsorbent) might be expected to yield one of the three components in a pure state. Which one?

(a) the minor enantiomer
(b) the meso isomer
(c) the major enantiomer
(d) the 1:1 racemic form of tartaric acid

Passage 2

(a) When 1-chloro-2-pentene is reacted with concentrated solution of sodium ethoxide, the rate of reaction depends on the concentration of both allylhalide and ethoxide ion. The product of reaction is exclusively

$$CH_3–CH_2–CH=CH–CH_2OC_2H_5$$

(b) In dilute solution of sodium ethoxide, the reaction rate is dependent only on the concentration of allylhalide.

(c) In the presence of traces of water, 1-chloro-2-pentene is slowly converted to a mixture of

1-chloro-2-pentene and 3-chloro-1-pentene

82. In case (a) the mechanism exclusively followed by reaction is

(a) S_N1 (b) S_N2 (c) E_1 (d) E_2

83. The intermediate formed in case (c) is

(a) $CH_3-CH_2-\overset{\oplus}{C}H-CH=CH_2$ (b) $CH_3-CH_2-CH=CH-\overset{\oplus}{C}H_2$
(c) both (a) and (b) (d) none

84. Correct statement is

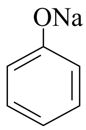
(a) The solvolysis of 1-chloro-2-pentene is greater than 1-chloropentane in water
(b) The solvolysis of 1-chloro-2-pentene is lesser than 1-chloropentane in water
(c) The solvolysis of 1-chloro-2-pentene and 1-chloropentane is equal in water
(d) The solvolysis of 1-chloro-2-pentene and 1-chloropentane do not take place in water

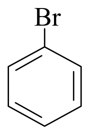
Passage 3

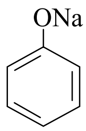
Williamson's ether synthesis is one of the best method to prepare ether. In this method ethers can be prepared by the reaction of alkoxides with alkyl halide. The reaction takes place by S_N2 mechanism. The more basic alkoxide ion displaces the halide or other leaving group to produce ether. While going for Williamson's ether synthesis one should be aware of competitive reactions. The mechanism take palces as

$$R-\overset{\ominus}{O} + R'-X \xrightarrow{S_N2} R-O-R' + \overset{\ominus}{X}$$

85. Which combination will be better to prepare anisole

(a)  + CH_3F

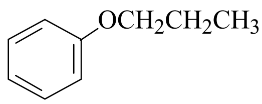
(b)  + CH_3ONa

(c)  + $CH_3OSO_2OCH_3$

(d) Both (a) and (c) can be used

86. The ether that cannot be synthesized by the above method is

(a) $CH_3-O-C(CH_3)_2-CH_3$

(b) 

(c) $(CH_3)_3C-O-C(CH_3)_3$

(d) All can be prepared

87. Which one of the following will give most effective yield of ether?

(a) $CH_3CH_2O^- + CH_3CH_2CH_2CH_2Br$

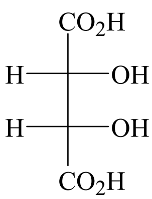
(b) $CH_3CH_2O^{\ominus} + CH_3-CH(CH_3)-CH_2Br$

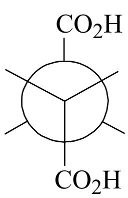
(c) $CH_3CH_2O^{\ominus} + CH_3-C(CH_3)_2-Br$

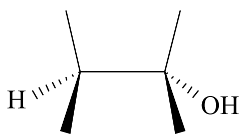
(d) $PhO^- + CH_3-CH(CH_3)-Br$

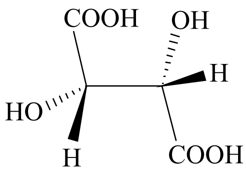
Passage 4

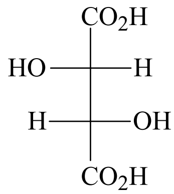
The specific rotation of (2R, 3R) – (+) – tartaric acid is +12.4° (c = 2, H_2O). The optical rotation of a solution made up from 10 g of a mixture B and C in 20 ml of water was measured in a 10 cm cell. The observed rotation was –3.1°.

(a) 

(b) 

(c) 

(d) 

(e) 

88. What is the specific rotation of A?

(a) +12.4° (b) 0°
(c) –12.4° (d) None of these

89. What is the specific rotation of the mixture?

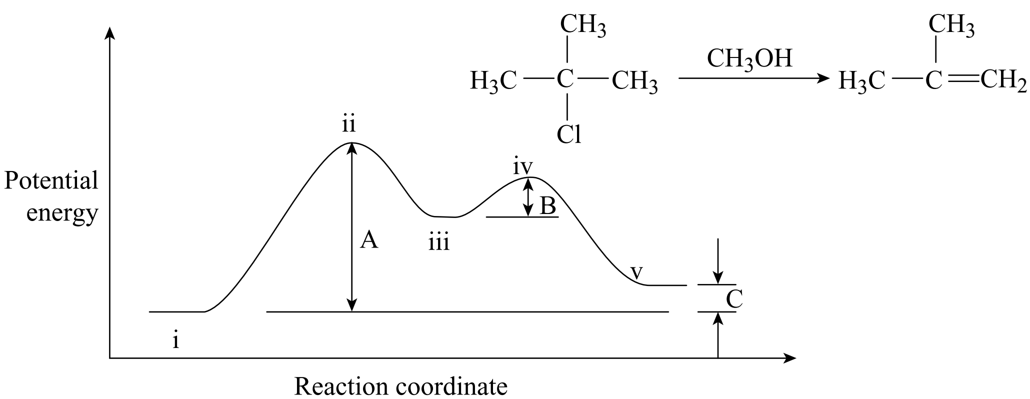
(a) –3.1° (b) –6.2° (c) –0.62° (d) +12.4°

90. What is the relative ratio of B:C in the mixture?

(a) 0:100 (b) 50:50 (c) 25:75 (d) 75:25

Passage 5

Based on the potential energy diagram for the following reaction



91. Is this an endothermic or exothermic reaction?

(a) exothermic
(b) There is not enough information to determine.
(c) endothermic
(d) This reaction can be either exothermic or endothermic.

92. What potential energy difference represents the heat of reaction?

(a) A (b) B
(c) C (d) Both A and B

93. Which of the following indicates the location of intermediate?

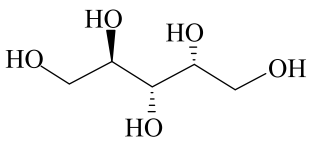
(a) i (b) ii (c) iii (d) iv

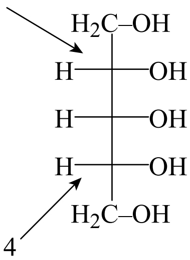
94. According to the potential energy diagram, what is the possible mechanism for the reaction?

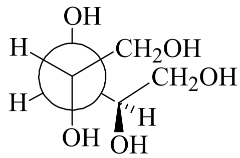
(a) E_1 (b) E_2 (c) S_N1 (d) S_N2

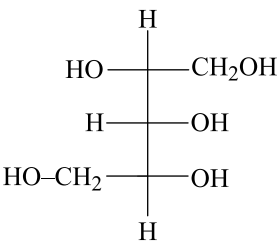
Passage 6

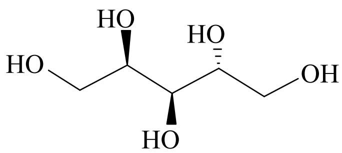
Based on the following five structures (i–v) shown below, answer questions 99 to 106.

(i) 

(ii) 

(iii) 

(iv) 

(v) 

95. What type of isomers are (i) and (iv)?

(a) diastereomers (b) conformational
(c) identical (d) enantiomers

96. What type of isomers are (i) and (iii)?

(a) diastereomers (b) conformational
(c) identical (d) enantiomers

97. If the specific rotation of i is –60.0°, what is the specific rotation of iii, if 1.0 g of iii is dissolved in 10 mL of methanol and placed in a 1 dm tube?

(a) +60° (b) 0° (c) 6° (d) –60°

98. If the specific rotation of i is –60.0°, what is the specific rotation of iv, if 1.0 g of iv is dissolved in 10 mL of methanol and placed in a 1 dm tube?

(a) +60° (b) 0° (c) 6° (d) –60°

99. If the specific rotation of (i) is –60.0°, what is the observed rotation of a sample made up of a mixture of 1 g of (i) and 0.5 g of (v) when dissolved in water (10 mL) and placed in a 10 cm cell?

(a) 60° (b) 0° (c) 6° (d) –60°

100. If the specific rotation of i is –60.0°, what is the optical purity of a sample of made up of a mixture of 1 g of (i) and 0.5 g of (v) when dissolved in water (10 mL)?

(a) 50 per cent (b) 33 per cent (c) 100 per cent (d) 66 per cent

101. Assign the absolute configuration to carbon atoms 2 and 4 in compound (ii).

(a) 2R, 4S (b) 2S, 4S (c) 2S, 4R (d) 2R, 4R

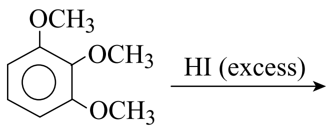
102. If the melting point of pure iv is 152°C, what is the melting point of pure (v)?

(a) –152°C (b) 152°C
(c) lower than 152°C (d) higher than 152°C

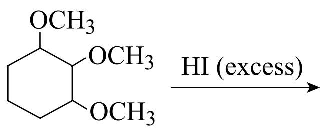
Matrix Type

Match the reaction mechanism in Column I with their reaction conditions in Column II

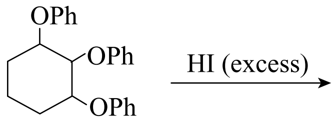
103. Column I | **Column II**

(a) 

(p) More than 4 moles of HI will be consumed

(b) 

(q) Product will react with Na

(c) 

(r) Product formed contains 2° halide

(d) $CH_2–OH$ / $CH–OH$ / $CH_2–OH$ $\xrightarrow{\text{HI (excess)}}$

(s) CH_3I is one of the product

104. Column I | **Column II**

(a) S_N1
(b) S_N2
(c) E_1
(d) E_2

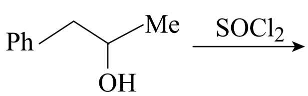
(p) 3° alkyl halides > 2° alkyl halides > 1° alkyl halides
(q) 1° alkyl halides > 2° alkyl halides > 3° alkyl halides
(r) High concentration of strong base
(s) Favourable medium is polar protic solvent

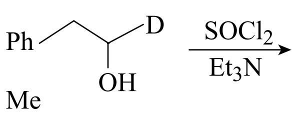
105. Column I | **Column II**

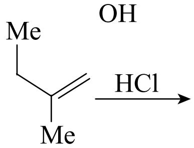
(a) Walden inversion
(b) Racemic mixture
(c) Alkene $\xrightarrow[\text{reagent}]{\text{Bayer's}}$
(d) Alkene $\xrightarrow{Br_2}$

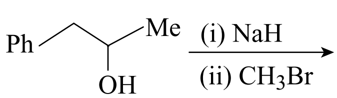
(p) Syn-addition
(q) Anti-addition
(r) S_N1 reaction
(s) S_N2 reaction

106. Column I (reaction) | **Column II (comment on major product and intermediate)**

(a) 

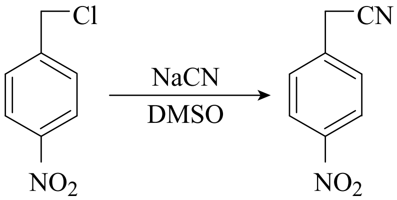
(b) 

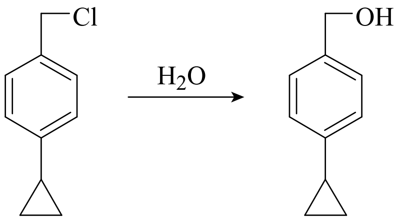
(c) 

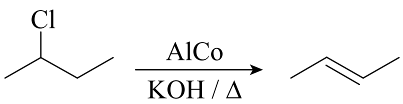
(d) 

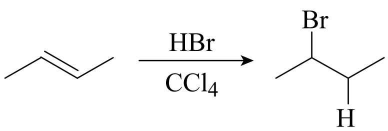
(p) Optically active compound
(q) Inversion of configuration
(r) Retention of configuration
(s) Optically inactive compound
(t) Carbocation intermediate

107. Column I | **Column II**

(a) 

(b) 

(c) 

(d) 

(p) Carbocation intermediate is formed

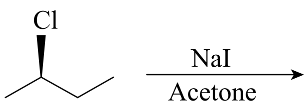
(q) S_N1

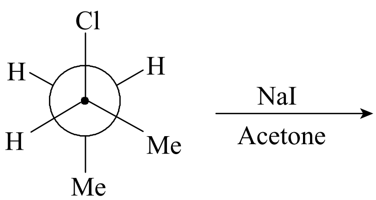
(r) S_N2

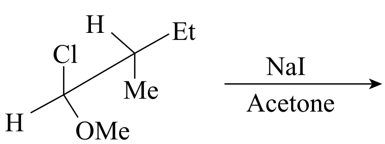
(s) Addition reaction

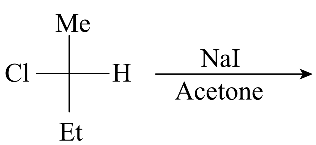
(t) Elimination reaction

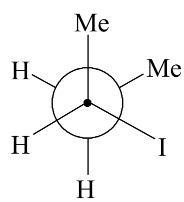
108. Column I | **Column II**

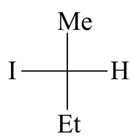
(a) 

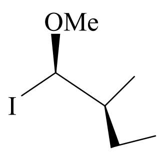
(b) 

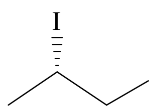
(c) 

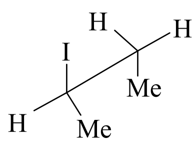
(d) 

(p) 

(q) 

(r) 

(s) 

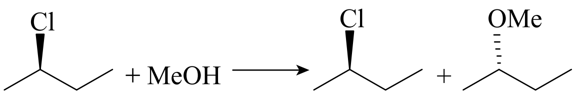
(t) 

109. Column I

(a) $NaOH + H_3C-Cl \longrightarrow HO-CH_3 + NaCl$

(b) $NH_3 + H_3C-Cl \longrightarrow H_2N-CH_3 + HCl$

(c) $NH_3 + Me_3S^{\oplus} \longrightarrow H_2N-Me + SMe_2$

(d) 

Column II

(p) Rate of reaction increases in polar protic solvent

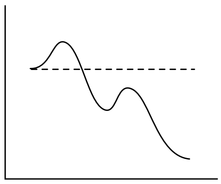
(q) Rate of reaction increases in polar aprotic solvent

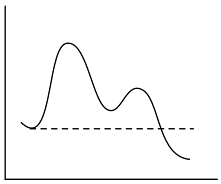
(r) S_N2 mechanism

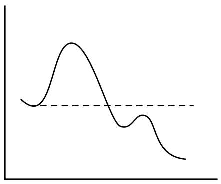
(s) S_N1 mechanism

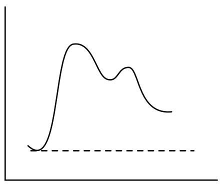
(t) TS has positive charge [non-zwitter ion]

110. Column I
(energy profile)

(a) 

(b) 

(c) 

(d) 

Column II
(chain propagation of halogenation)

(p) Iodination

(q) Fluorination

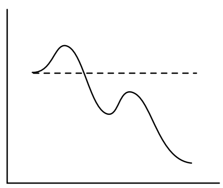
(r) Chlorination

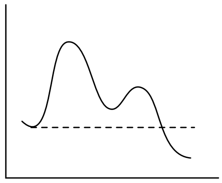
(s) Bromination

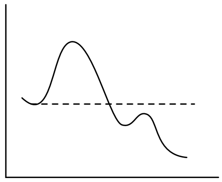
111. Column I
(RDS of halogenation)

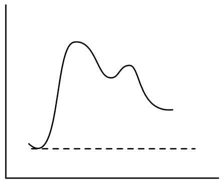
(a) $R-H + F\bullet \longrightarrow R\bullet + H-F$

Column II
(energy profile)

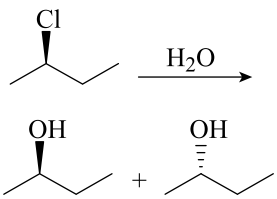
(p) 

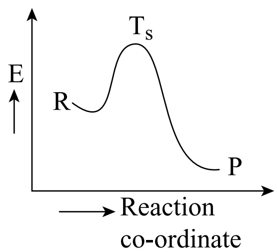
(b) $R-H + Cl\bullet \longrightarrow R\bullet + H-Cl$ (q) 

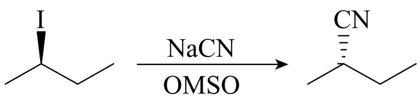
(c) $R-H + Br\bullet \longrightarrow R\bullet + H-Br$ (r) 

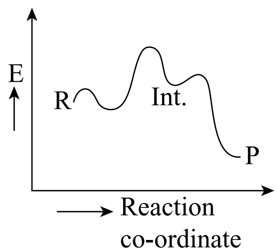
(d) $R-H + I\bullet \longrightarrow R\bullet + H-I$ (s) 

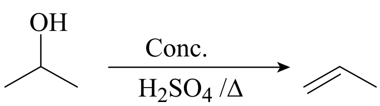
112. Column I **Column II**

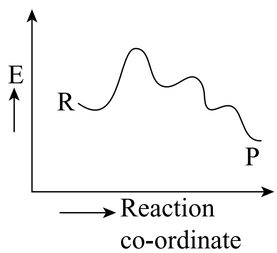
(a) 

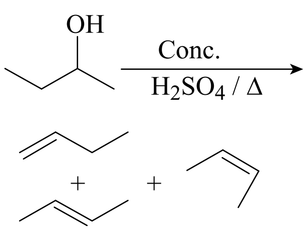
(p) 

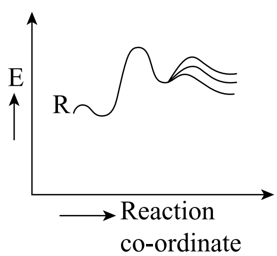
(b) 

(q) 

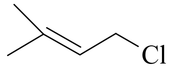
(c) 

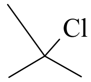
(r) 

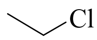
(d) 

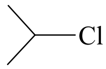
(s) 

113. **Column I** **(compounds)** / **Column II** **(rate of solvolsis)**

(a)  (p) 0.07

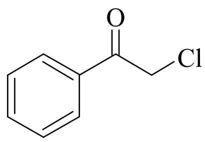
(b)  (q) 0.12

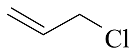
(c)  (r) 2100

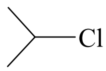
(d)  (s) 130000

114. **Column I** **(compound)** / **Column II** **(rate of reaction with NaI acetone)**

(a) Me–Cl (p) 0.02

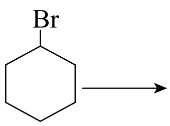
(b)  (q) 100000

(c)  (r) 200

(d)  (s) 79

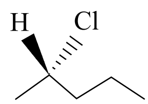
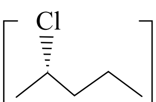
Integer Type

115. Minimum number of steps involved in conversion of



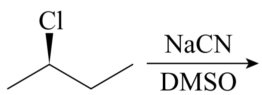
$OHC-\overset{D}{\overset{|}{C}}H-CH_2-CH_2-CH_2-CHO$

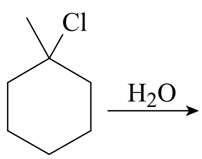
116. When (S)-2-chloropentane reacts with NaOH in 75 per cent EtOH and 25 per cent acetone follows rate law:

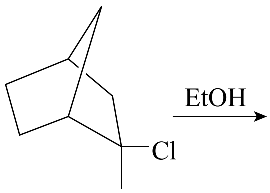
Rate = 2.35×10^{-5} [].[OH] + 5.30×10^{-6} []

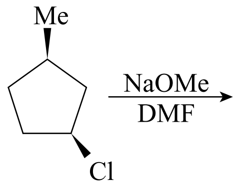
Then, calculate percentage of S_{N1} product when concentration of [OH] = 1.5 molar. If percentage of S_N1 product = X, then calculate value of Y if: Y= X – 5.

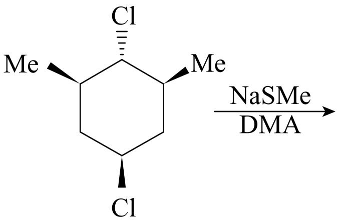
117. Identify total number of S_N1 reactions

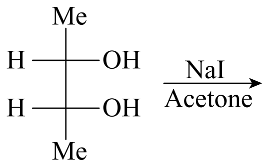
(i) 

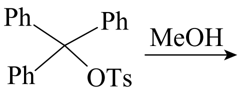
(ii) 

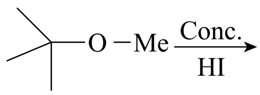
(iii) 

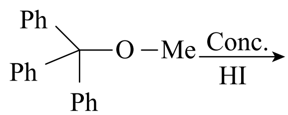
(iv) 

(v) 

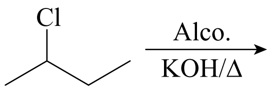
(vi) 

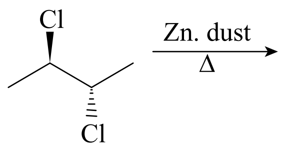
(vii) 

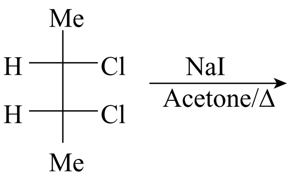
(viii) 

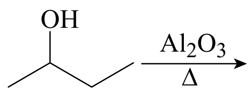
(ix) 

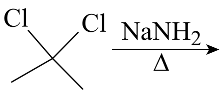
118. Identify total number of 'β'-elimination reactions

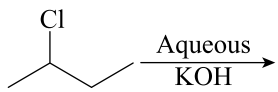
(i) 

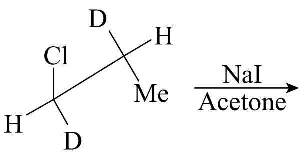
(ii) 

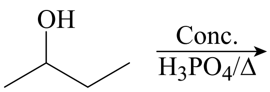
(iii) 

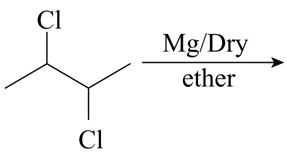
(iv) 

(v) 

(vi) 

(vii) 

(viii) 

(ix) 

119. Calculate percentage of S_N1 product if (R) -2-chloro butane on reaction with NaOH/H_2O and acetone gives 98 per cent inverted product.

120. Calculate total number of alkene products when 2-chloro-2-cyclobutyl hexane react with alcoholic KOH and heat.

121. Calculate total number of α-H present in alkene formed when 2, 3-dimethyl butanol react with concentrated H_2SO_4/Δ.

Answer Keys

LEVEL 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
b	b	c	c	a	d	c	b	d	c	a	b	c	a	d
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
a	d	d	d	d	c	c	d	b	c	b	c	d	d	d
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
b	d	d	b	a	d	c	d	d	b	a	b	a	c	c
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
b	a	a	d	a	d	c	b	d	a	c	a	b	a	d
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
d	a	d	b	a	a	b	b	d	c	b	b	b	a	a
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
c	b	a	c	d	d	d	a	a	a	b	a	a	a	b
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
d	a	d	b	c	a	a	b	b	a	b	b	b	d	b
106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
b	d	a	c	d	c	d	c	a	d	c	cd	a	d	c
121	122	123	124	125	126	127	128	129	130					
d	b	d	a	b	b	c	b	bc	d					

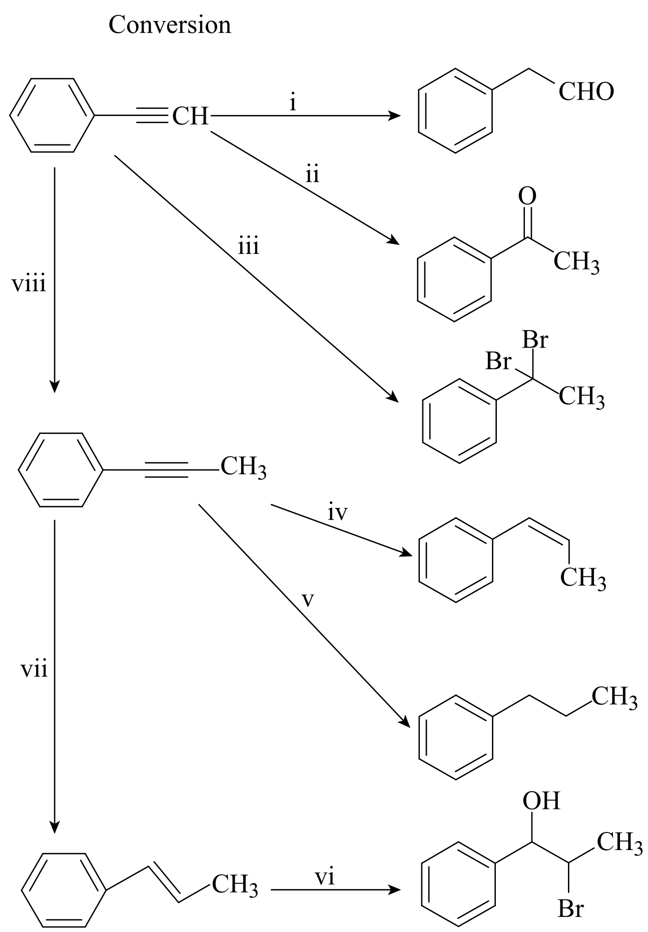
LEVEL 2

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
bd	a	a	a	d	ab	bcd	a	ac	acd	ad	abc	bcd	abc	bc
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
d	abc	ab	ac	a	abd	b	b	a	c	a	c	a	a	c
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
d	d	d	d	abd	cd	b	a	c	c	abd	b	c	c	d
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
d	b	a	c	c	d	d	a	c	a	b	d	d	a	b
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
a	a	a	bc	d	bc	acd	ab	abcd	abd	bc	ad	c	d	c
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90

d	ab	a	c	a	d	b	c	a	c	c	a	bcd	b	d
91	92	93	94	95	96	97	98	99	100	101	102	103(a)	103(b)	103(c)
c	c	c	a	d	a	b	a	d	c	ac	b	qs	pqrs	pqr
103(d)	104(a)	104(b)	104(c)	104(d)	105(a)	105(b)	105(c)	105(d)	106(a)	106(b)	106(c)	106(d)	107(a)	107(b)
pqr	ps	qr	ps	pr	s	r	p	q	prt	pq	st	pr	r	pq
107(c)	107(d)	108(a)	108(b)	108(c)	108(d)	109(a)	109(b)	109(c)	109(d)	110(a)	110(b)	110(c)	110(d)	111(a)
t	ps	ps	ps	r	s	qr	prt	qrt	pst	q	s	r	p	p
111(b)	111(c)	111(d)	112(a)	112(b)	112(c)	112(d)	113(a)	113(b)	113(c)	113(d)	114(a)	114(b)	114(c)	114(d)
r	q	s	r	p	q	s	s	r	p	q	r	q	s	p
115	116	117	118	119	120	121								
5	8.233	5	6	4	4	12								

WORKBOOK EXERCISES

EXERCISE 1



Reagents

(A) BH_3/THF, then NaOH, H_2O_2, H_2O

(B) H_3O^+

(C) $HgSO_4$/aq. H_2SO_4

(D) CH_3I

(E) Excess HBr

(F) CH_3CH_2I

(G) Br_2/CCl_4

(H) NaOH

(I) H_2/Pd

(J) Br_2/H_2O

(K) $H_2/Pd/CaCO_3/Pb$

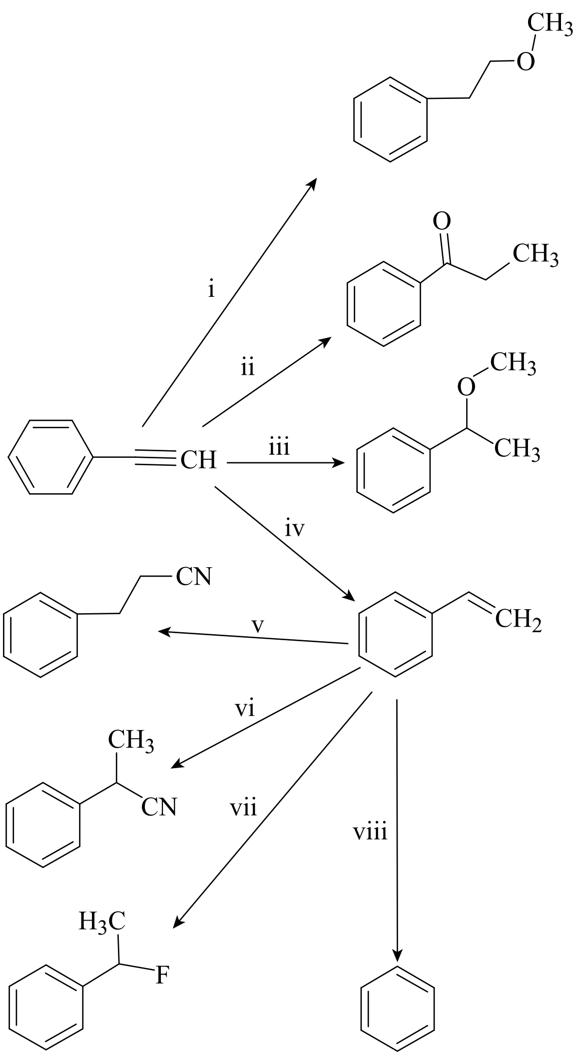
(L) HBr/UV light

(M) $NaNH_2/NH_3$ (l)

(N) Na/NH_3 (l)

EXERCISE 2

Conversion



Reagents

(A) $HgSO_4$, aq. H_2SO_4

(B) (i) $NaNH_2$ then add MeI
 (ii) $HgSO_4$, aq. H_2SO_4

(C) (i) $NaNH_2$, then add MeI
 (ii) BH_3, then H_2O_2, NaOH, H_2O

(D) (i) BH_3, then H_2O_2, NaOH, H_2O
 (ii) Na then MeI

(E) (i) H_2/Lindlar's catalyst
 (ii) BH_3, then H_2O_2, NaOH, H_2O
 (iii) MeOH

(F) (i) H_2/Lindlar's catalyst
 (ii) BH_3, then H_2O_2, NaOH, H_2O
 (iii) Na then MeI

(G) (i) H_2/Lindlar's catalyst
 (ii) aq. H_2SO_4
 (iii) MeOH

(H) (i) H_2/Lindlar's catalyst
 (ii) aq. H_2SO_4
 (iii) Na, then MeI

(I) (i) aq. H_2SO_4 (ii) Na, then MeI

(J) Na in NH_3 (1)

(K) H_2/Lindlar's catalyst

(L) H_2/Pd

(M) HCN

(N) (i) H_2/Pd (ii) NaCH/DMSO

(O) (i) aq. H_2SO_4 (ii) NaCN/DMSO

(P) (i) HBr, H_2SO_2 (ii) NaCN/DMSO

(Q) HF/Pyridine

(R) (i) H_2/Pd or Ni (ii) NaF/DMSO

(S) (i) HBr, H_2O_2 (ii) NaF/DMSO

(T) (i) HBr (dark, N_2) (ii) NaF/EtOH

(U) (i) HBr (dark, N_2) (ii) NaF/DMSO

(V) (i) HBr H_2O_2 (ii) H_2S

(W) (i) HBr, (dark, N_2) (ii) H_2S

(X) H_2S/EtOH

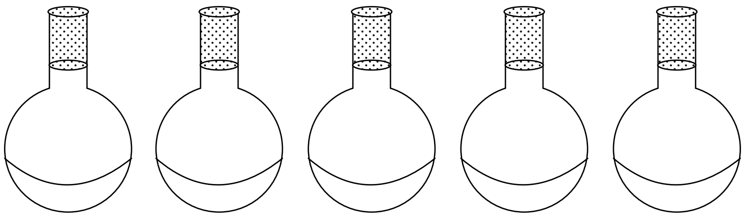
(Y) (i) HBr (dark, N_2) (ii) NaCN/DMSO

EXERCISE 3

There are 18 alkene isomers with the molecular formula C_6H_{12}, and they are all drawn (A-R) in the box at the bottom of this page. You are presented with five flasks (1 to 5), each one containing a single pure sample of one of these alkenes. In a very long and excruciating lab class one afternoon, you run two separate reactions on each sample (i) ozonolysis (O_3 followed by Me_2S) and (ii) bromination (Br_2/CCl_4). For the ozonolysis reactions, you analyse what kind of stereoisomers (if any) are formed in each reaction. The results of the two reactions for each flask are summarized below that flask. Using your knowledge of alkene reactions, identify each sample (1 to 5) as as ONE of the alkenes drawn below (A-R) by writing that letter in the small box below:

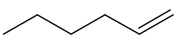
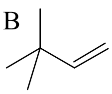
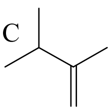
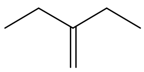
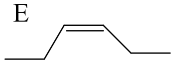
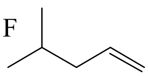
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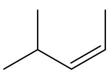
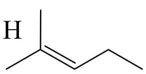
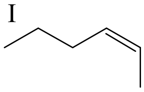
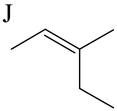
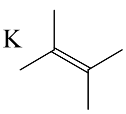
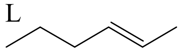
Racemic mixture (Rac)
Diastereoisomers (Dia)
Achiral meso compound
Achiral, non-meso compound (Ach)

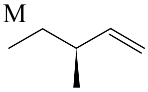
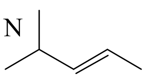
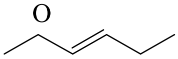
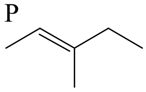
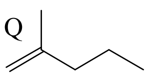
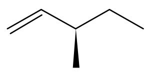


	1	2	3	4	5
Number of unique ozonolysis (O_3) products	One	One	One	Two	Two
Reaction with Br_2 in CCl_4 gives	Ach	Rac	Meso	Ach	Dia
IDENTITY OF SAMPLE ⇨					

Note: For one of the samples, there are two correct answers, but you only need to indicate one of them.

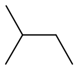
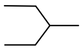
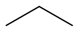
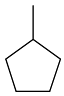
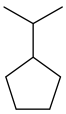
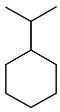
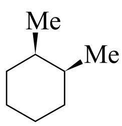
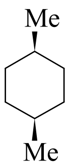
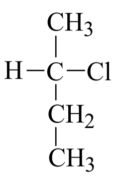
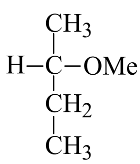
A 
B 
C 
D 
E 
F 

G 
H 
I 
J 
K 
L 

M 
N 
O 
P 
Q 
R 

EXERCISE 4

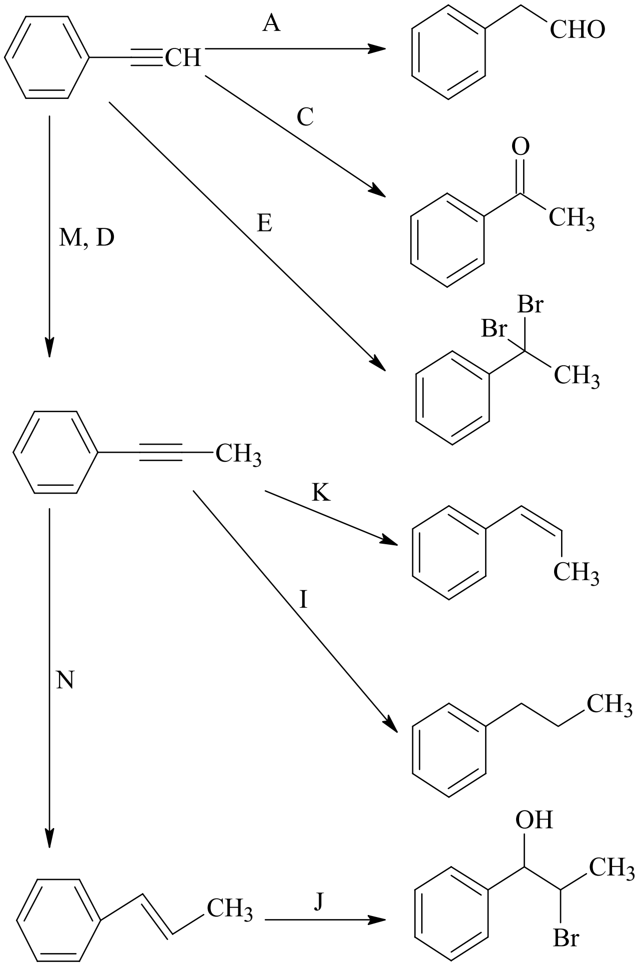
Match alkanes with their products.

Alkanes	Total Number of Mono-chloro Products	Total Number of Mono-chloro Fractions After Distillation
(i) 	(A) 6	(a) 2
(ii) 	(B) 12	(b) 3
(iii) 	(C) 14	(c) 4
(iv) 	(D) 16	(d) 5
(v) 	(E) 8	(e) 6
	(F) 4	(f) 7
(vi) 	(G) 5	(g) 8
(vii) 	(H) 10	(h) 9
	(I) 8	(i) 10
(viii) 	(J) 16	(j) 11
	(K) 7	(k) 12
(ix) 	(L) 5	(l) 13
	(M) 13	(m) 14
(x) 	(N) 3	(n) 16

Solution for Workbook Exercises

EXERCISE 1

Conversion



Reagents

(A) BH_3/THF then NaOH, H_2O_2, H_2O

(B) H_3O^+

(C) $HgSO_4$/aq. H_2SO_4

(D) CH_3I

(E) Excess HBr

(F) CH_3CH_2I

(G) Br_2/CCl_4

(H) NaOH

(I) H_2/Pd

(J) Br_2/H_2O

(K) $H_2/Pd/CaCO_3$

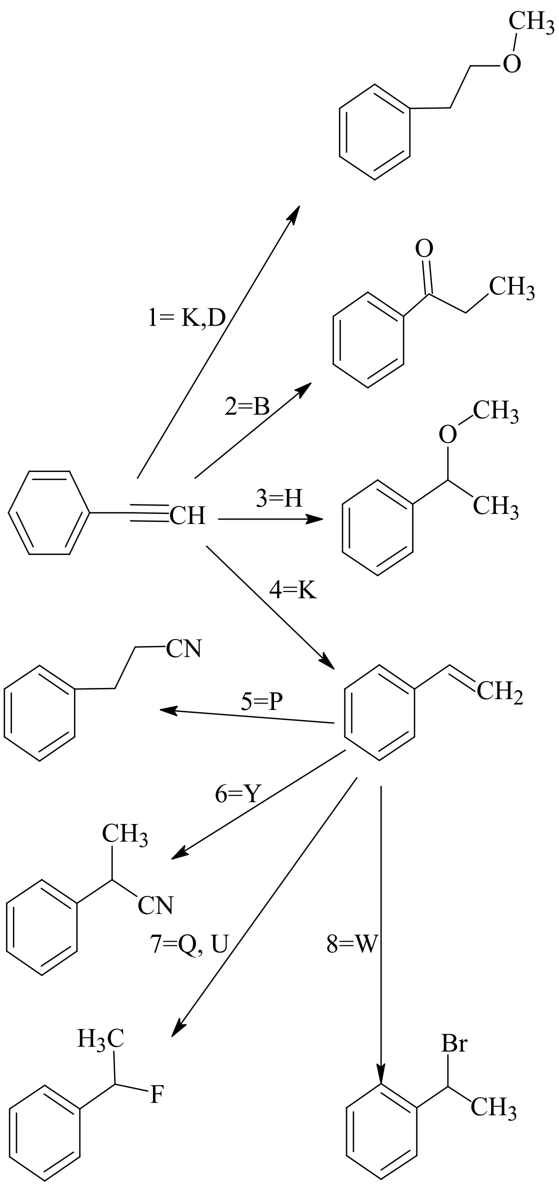
(L) HBr/uv light

(M) $NaNH_2/NH_3$ (l)

(N) Na/NH_3 (l)

EXERCISE 2

Conversion



Reagents

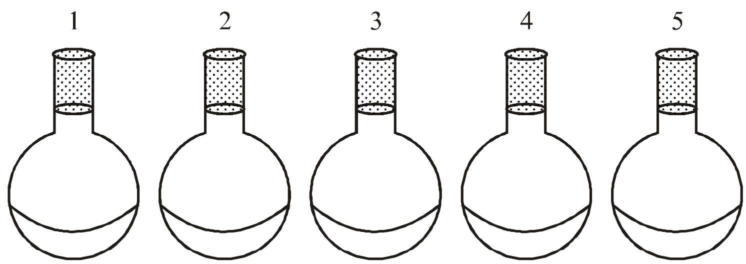
(A) $HgSO_4$, aq. H_2SO_4
(B) (i) $NaNH_2$ then add MeI.
(ii) $HgSO_4$, aq. H_2SO_4
(C) (i) $NaNH_2$ then add MeI.
(ii) BH_3, then H_2O_2, NaOH, H_2C
(D) (i) BH_3, then H_2O_2, NaOH, H_2O
(ii) Na then MeI
(E) (i) H_2 / Lindlar catalyst.
(ii) BH_3, then H_2O_2, NaOH, H_2C
(iii) MeOH
(F) (i) H_2 / Lindlar catalyst.
(ii) BH_3, then H_2O_2, NaOH, H_2C
(iii) Na then MeI
(G) (i) H_2 / Lindlar catalyst.
(ii) aq. H_2SO_4
(iii) MeOH
(H) (i) H_2 / Lindlar catalyst.
(ii) aq. H_2SO_4
(iii) Na then MeI
(I) (i) aq. H_2SO_4
(ii) Na then MeI
(J) Na in NH_3 (l)
(K) H_2 / Lindlar catalyst.
(L) H_2 / Pd
(M) HCN
(N) (i) H_2 / Pd.
(ii) NaCN / DMSO
(O) (i) aq. H_2SO_4
(ii) NaCN / DMSO
(P) (i) HBr, H_2O_2
(ii) NaCN / DMSO
(Q) HF / Pyridine
(R) (i) H_2 / Pd or Ni.
(ii) NaF / DMSO
(S) (i) HBr, H_2O_2
(ii) NaF / DMSO
(T) (i) HBr (dark, N_2)
(ii) NaF / EtOH
(U) (i) HBr (dark, N_2)
(ii) NaF / DMSO
(V) (i) HBr, H_2O_2
(ii) H_2S
(W) (i) HBr (dark, N_2)
(ii) H_2S
(X) H_2S / EtOH
(Y) (i) HBr (dark, N_2)
(ii) NaCN / DMSO

EXERCISE 3

There are 18 alkene isomers with the molecular formula C_6H_{12}, and they are all drawn (A-R) in the box at the bottom of this page. You are presented with five flasks (1 to 5), each one containing a single pure sample of one of these alkenes. In a very long and excruciating lab class one afternoon, you run two separate reactions on each sample (i) ozonolysis (O_3 followered by Me_2S), and (ii) bromination (Br_2/CCl_4). For the ozonolysis reactions, you analyse what kind of stereoisomers (if any) are formed in each reaction. The results of the two reactions for each flask are summarized below that flask. Using your knowledge of alkene reactions, identify each sample (1 to 5) as ONE of the alkenes drawn below (A-R) by writing that letter in the small box below:

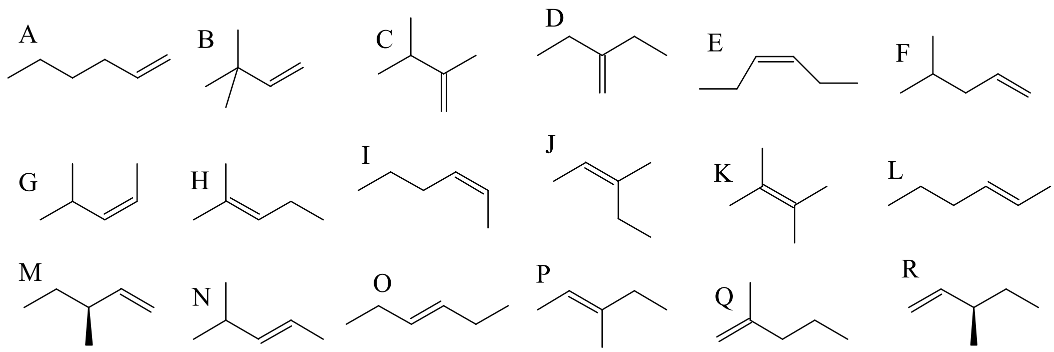
Key

- Racemic mixture (Rac)
- Diastereoisomers (Dia)
- Achiral meso compound
- Achiral, non-meso compound (Ach)

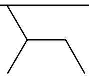
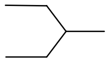
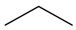
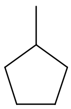
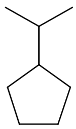
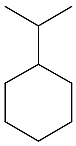
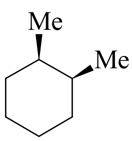
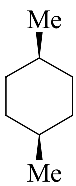


	1	2	3	4	5
Number of Unique Ozonolysis (O_3) Products	One	One	One	Two	Two
Reaction with Br_2 in CCl_4 gives	Ach	Rac	Meso	Ach	Dia
IDENTITY OF SAMPLE ⇨	K	E	O	D	M, R

Note: For one of the samples, there are two correct answers, but you only need to indicate one of them.



EXERCISE 4

Alkanes	Total Number of Mono-chloro Products	Total Number of Mono-chloro Fractions After Distillation
(i)  --A,c	(A) 6	(a) 2
(ii)  --E,d	(B) 12	(b) 3
(iii)  --N,a	(C) 14	(c) 4
(iv)  --H,e	(D) 16	(d) 5
(v)  --B,f	(E) 8	(e) 6
(vi)  --C,g	(F) 4	(f) 7
(vii)  --C,f	(G) 5	(g) 8
(viii)  --K,d	(H) 10	(h) 9
(ix) $H-C(CH_3)(Cl)-CH_2-CH_3$ --L,d	(I) 8	(i) 10
(x) $H-C(CH_3)(OMe)-CH_2-CH_3$ --K,e	(J) 16	(j) 11
	(K) 7	(k) 12
	(L) 5	(l) 13
	(M) 13	(m) 14
	(N) 2	(n) 16

CHAPTER 5

Carbonyl Compounds and Acid Derivatives

Question Bank

LEVEL 1

1. When phenyl ethanoate is alkylated with chloroethane/$AlCl_3$, the para product is the major product. This is because

(a) Alkylation usually occurs at the para position.

(b) The -Cl group is a weakly deactivating and an ortho/para director.

(c) The -OCOMe group is an activator and an ortho/para director.

(d) The -Et group is weakly activating and an ortho/para director.

2. Terminal alkynes react with 9-borabicyclononane (9-BBN) and then aq. alkaline hydrogen peroxide to give aldehydes because

(a) Acid catalysed electrophilic addition of water follows Markovnikov's rule.

(b) Acid catalysed electrophilic addition of water is anti-Markovnikov.

(c) The radical addition is anti-Markovnikov.

(d) Steric and electronic effects cause the boron to the terminal carbon.

3. In general, ketones are more reactive towards nucleophiles than esters because

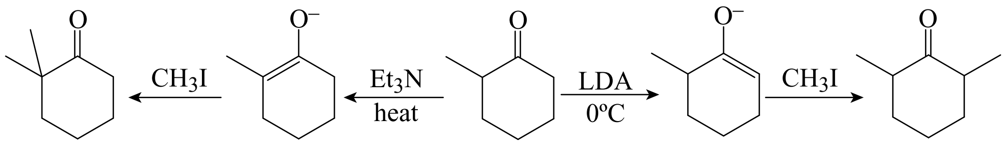
(a) The α-protons of a ketone are more acidic than those of an ester.

(b) The alkyl group in a ketone is an electron donating group due to hyperconjugation.

(c) Alkoxy (RO-) groups are sterically larger than the related alkyl group.

(d) Alkoxy (RO-) groups are stronger electron donating than alkyl groups via resonance.

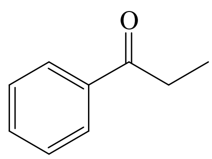
4. When 2-methylcyclohexanone reacts with a base and is then treated with an electrophile such as methyl iodide the product depends on the reaction conditions, see below. At high temperature, the major product is the geminal dimethyl compound. This is because



(a) Alkyl groups are weak electron donors due to inductive effects and hyperconjugation.
(b) The enolate formed at high temperature is more stable.
(c) diisopropyl amide (LDA) is a much stronger base than Et_3N.
(d) Lithium diisopropyl amide (LDA) promotes an anti-Markovnikov type addition.

5. The reaction of a Grignard reagent with a carboxylic acid does not give a secondary alcohol. This is because
(a) Grignard reagents only react with the aldehydes, ketones, esters and epoxides.
(b) The carboxylic acid is too sterically hindered to react.
(c) The carboxylic acid is not electrophilic enough to react.
(d) The Grignard reagent is a base, so an acid–base reaction occurs.

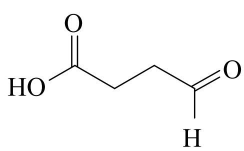
6. When 1-phenylpropyne reacts with $H_2O/HgSO_4/H_2SO_4$, the major product is propiophenone shown below. This is because



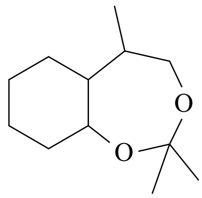
(a) Alkyl groups are weak electron donors due to inductive effects and hyperconjugation.
(b) Carbonyl groups are electron withdrawing groups due to resonance.
(c) Phenyl groups can stabilise positive charge by resonance.
(d) The reaction is controlled by steric factors.

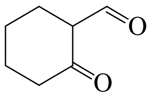
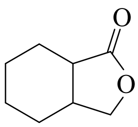
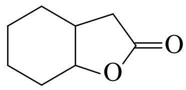
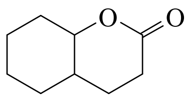
7. When methyl benzoate is nitrated with HNO_3/H_2SO_4, the meta product is the major product. This is because
(a) The $-CO_2CH_3$ group is a meta director.
(b) The $-OCH_3$ is a meta director.
(c) The $-NO_2$ group is deactivating and a meta director.
(d) Nitration usually occurs at the meta position.

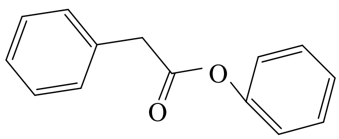
8. A chemist attempted to reduce the compound shown below with $NaBH_4$, but could not isolate the desired product 4-hydroxybutanoic acid. This is because

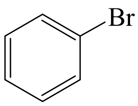
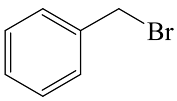
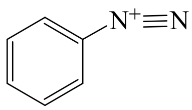
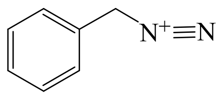


(a) $NaBH_4$ reduced both the carboxylic acid and the aldehyde.
(b) $NaBH_4$ is not reactive enough to reduce the carboxylic acid or the aldehyde.
(c) An intermediate was formed that reacted to give a cyclic acetal.
(d) An intermediate was formed that reacted to give a cyclic ester.

9. ? $\xrightarrow[\text{(ii) LiAlH}_4\text{ then H}_3\text{O+; (iii) TsOH, propanone, heat}]{\text{(i) LDA then methyl iodide}}$  Identify reactant

(a)  (b)  (c)  (d) 

10. ? $\xrightarrow[\text{(ii) H+, H}_2\text{O, heat; (iii) SOCl}_2\text{, Et}_3\text{N; (iv) Benzl alcohol, pyridine}]{\text{(i) NaCN}}$  Identify reactant

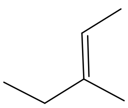
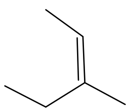
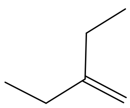
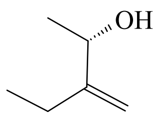
(a)  (b)  (c)  (d) 

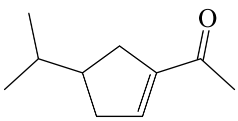
11. ? $\xrightarrow[\text{(ii) H}^+\text{, H}_2\text{O}]{\text{(i) CH}_3\text{CO}_3\text{H}}$

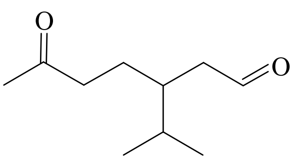
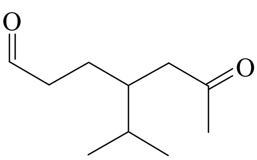
$$\begin{array}{c} CH_2CH_3 \\ | \\ H_3C-C-OH \\ | \\ HO-C-H \\ | \\ CH_3 \end{array} \quad + \quad \begin{array}{c} CH_2CH_3 \\ | \\ HO-C-CH_3 \\ | \\ H-C-OH \\ | \\ CH_3 \end{array}$$

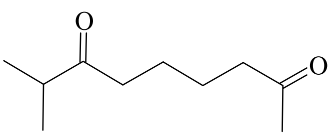
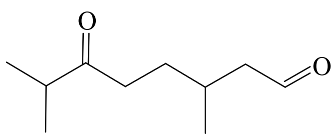
Identify reactant

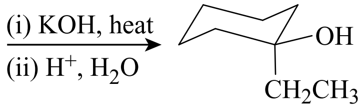
(50:50 of these enantiomers)

(a)  (b)  (c)  (d) 

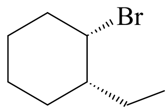
12. $\xrightarrow{\text{NaOEt, EtOH, heat}}$  Identify reactant

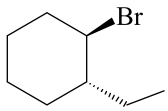
(a)  (b) 

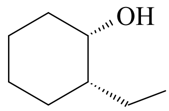
(c)  (d) 

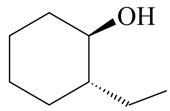
13. ? 

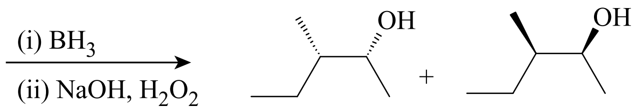
Identify reactant

(a) 

(b) 

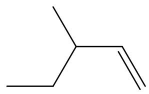
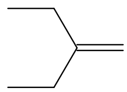
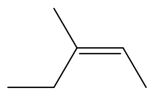
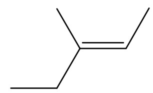
(c) 

(d) 

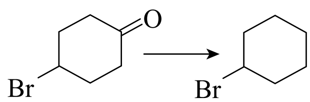
14. ? 

Identify reactant

(50:50 of these enantiomers)

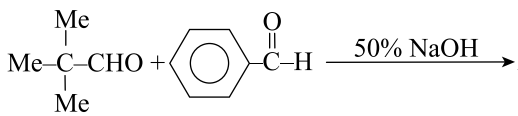
(a) 
(b) 
(c) 
(d) 

15. Appropriate reagent for the following conversion is



(a) NH_2NH_2; EtOH/OH^- (b) Red P + I_2 (c) Zn–Hg/HCl (d) All of them

16. In the given reaction

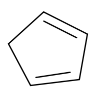
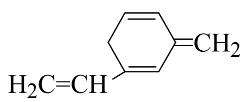


A + B; A and B are

(a) $Me_3C–CH_2OH$ + Ph–COO^- (b) $Me_3C–COO^-$ + Ph–CH_2OH

(c) Me–CH(Me)–C(=O)–Me + Ph–CH_2OH (d) Me–CH_2–C(=O)–Me + Ph–CH(CH_3)–OH

17. Which of the following gives glyoxal as one of the product on ozonolysis

(a) 
(b) 

(c) H_3C=CH–CH=CH_2 (d) Both (a) and (c)

18. The correct statement is

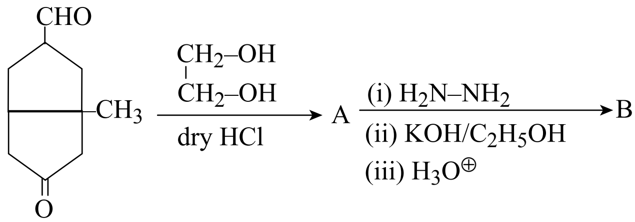
(a) chloral forms stable hydrate

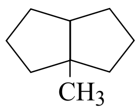
(b) methanal is more reactive than ethanal towards nucleophilic addition

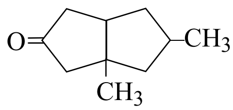
(c) protonated carbonyl group is more reactive towards KCN

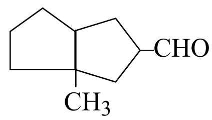
(d) all of them

19. In the given reaction sequence, the B is



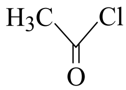
(a) 

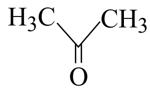
(b) 

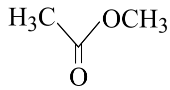
(c) 

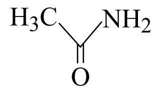
(d) none of these

20. The maximum reactive towards the nucleophilic attack is

(a) 

(b) 

(c) 

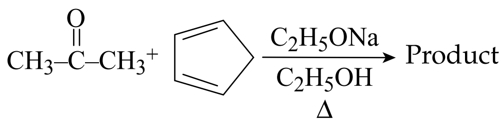
(d) 

21. Match column I (reaction) with column II (name of the reaction) and select the correct answer using the codes given.

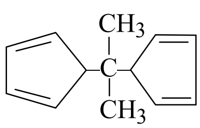
Column I	Column II
(a) $2C_6H_5CHO \xrightarrow{20\%\ NaOH}$	(i) Benzoin condensation
(b) $C_6H_5CHO + HCHO \xrightarrow{20\%\ NaOH}$	(ii) Self-Cannizzaro reaction
(c) $2C_6H_5CHO \xrightarrow{KCN/(alc.)}$	(iii) Cross Cannizzaro reaction
(d) $C_6H_5CHO + (CH_3CO)_2O \xrightarrow[\Delta]{CH_3COONa}$	(iv) Perkin reaction

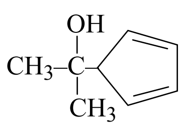
(a) a - i, b - ii, c - iii, d - iv
(b) a - ii, b - iii, c - i, d - iv
(c) a - i, b - iii, c - iv, d - ii
(d) a - ii, b - iii, c - iv, d - i

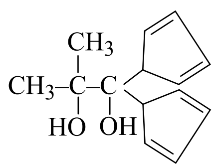
22. In the reaction

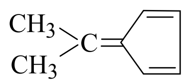


the product is

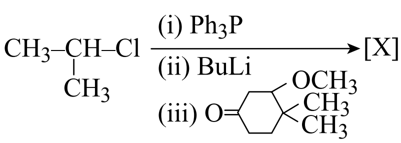
(a) 

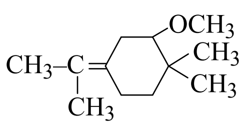
(b) 

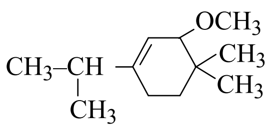
(c) 

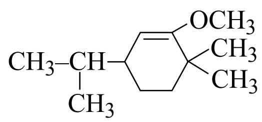
(d) 

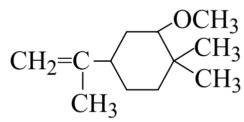
23. The product of the given reaction is



(a) 

(b) 

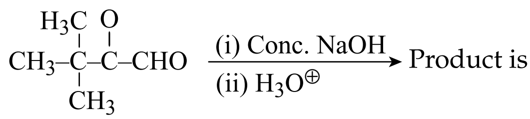
(c) 

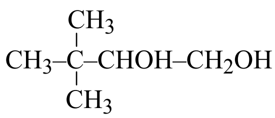
(d) 

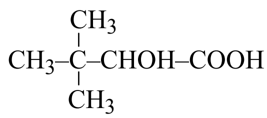
24. Which of the following gives positive Fehling's solution test

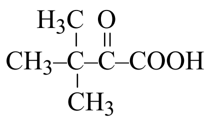
(a) Ph–CHO (b) CH_3CHO (c) CCl_3CHO (d) All of them

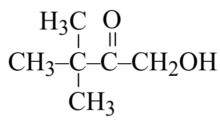
25. In the given reaction



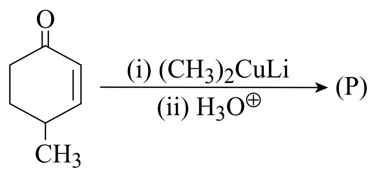
(a) 

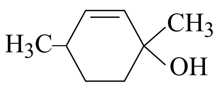
(b) 

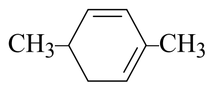
(c) 

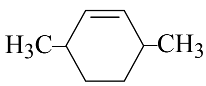
(d) 

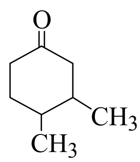
26. In the given reaction, (P) will be



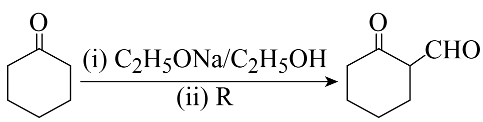
(a) 

(b) 

(c) 

(d) 

27. In the given reaction



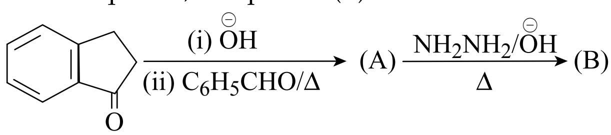
(R) would be

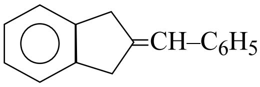
(a) HCHO (b) CH_3CHO (c) $HCOOC_2H_5$ (d) $(COOC_2H_5)_2$

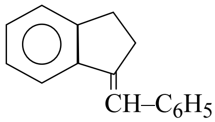
28. Aldehydes and ketones react with α-bromo esters and zinc in ether or benzene medium to yield

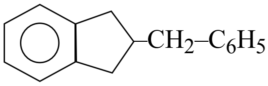
(a) α-keto ester (b) β-hydroxy ester (c) γ-keto acids (d) β-keto ester

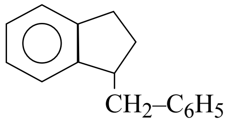
29. In the given reaction sequence, compound (B) is



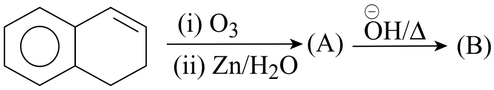
(a) 

(b) 

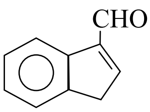
(c) 

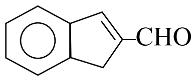
(d) 

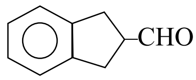
30. In the given reaction sequence

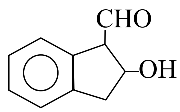


compound (B) is

(a) 

(b) 

(c) 

(d) 

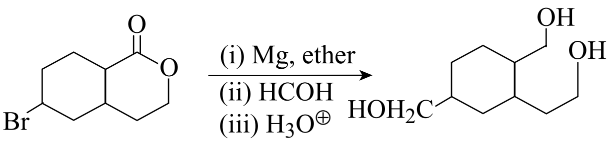
31. Two isomeric ketones, 3-pentanone and 2-pentanone can be distinguished by

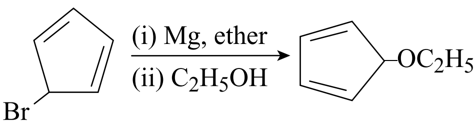
(a) I_2/NaOH (b) $NaHSO_3$ (c) NaCN/HCl (d) 2,4-DNP

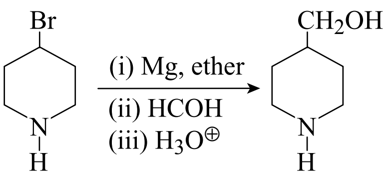
32. Silver mirror test with Tollen's reagent is given by

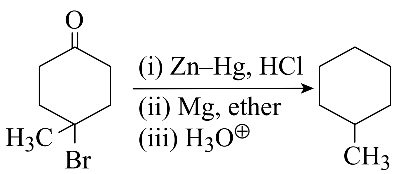
(a) C_6H_5CHO (b) Ph–OH (c) $C_6H_5-CH_2-\underset{\underset{O}{\|}}{C}-CH_2OH$ (d) CH_3CHO

33. Which of the following is a correct conversion?

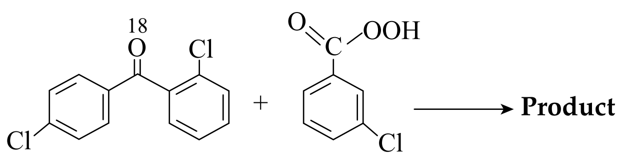
(a) 

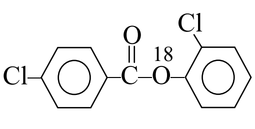
(b) 

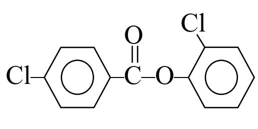
(c) 

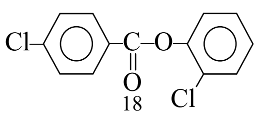
(d) 

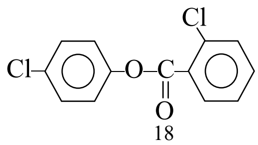
34. For the given reaction, the product is



(a) 

(b) 

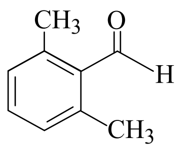
(c) 

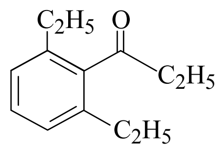
(d) 

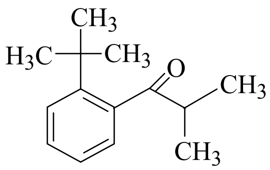
35. Which one of the following does not respond positive to iodoform test even on heating?

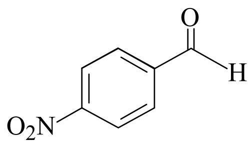
(a) $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-\underset{O}{\underset{\|}{C}}-OPh$ (b) $CH_3-\overset{Br}{\overset{|}{\underset{Br}{\underset{|}{C}}}}-CH_3$ (c) CH_3NO_2 (d) Both (a) and (b)

36. The rate of reduction of the following carbonyl compounds by $NaBH_4$

(i) 

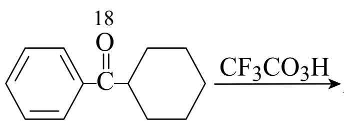
(ii) 

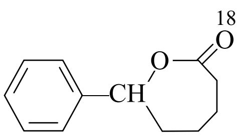
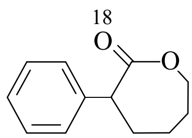
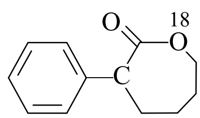
(iii) 

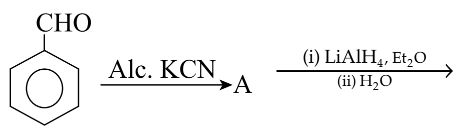
(iv) 

(a) iv > i > ii > iii (b) i > ii > iv > iii

(c) iii > ii > i > iv (d) ii > i > iii > iv

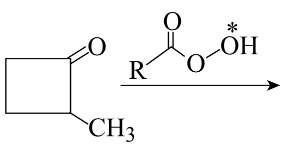
37.  A; product (A) is

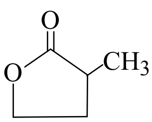
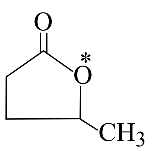
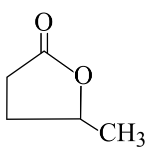
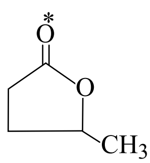
(a)  (b)  (c)  (d) None of these

38.  Products

The number of possible stereoisomers in the product mixture is

(a) 1 (b) 2 (c) 3 (d) 4

39.  A ; The product (A) is

(a)  (b)  (c)  (d) 

40. The incorrect statement amongest the following is

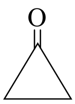
(a) The order of reduction reaction by $LiAlH_4$ and that of the reduction by $NaBH_4$ each is two

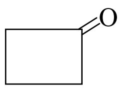
(b) Al–H bond is more ionic than B–H bond and hence $LiAlH_4$ can produce larger concentration of hydride ion than that of $NaBH_4$

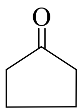
(c) $LiAlH_4$ cannot reduce $-NO_2$ group

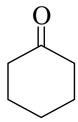
(d) Inspite of very small rate constant of reduction of any carbonyl function other than aldehydes and ketones, the rate of reduction with $LiAlH_4$ becomes appreciable due to large concentration of hydride ion

41. Which of the following ketones has the largest equilibrium constant for addition of water?

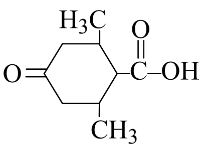
(a) 

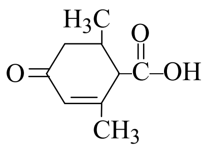
(b) 

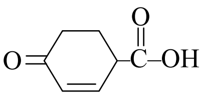
(c) 

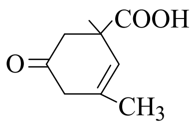
(d) 

42. Ethyl acetoacetate react with $CH_3-\overset{\overset{O}{||}}{C}-H$ in the presence of base/Δ followed by acidic hydrolysis and subjected to heat, product formed is

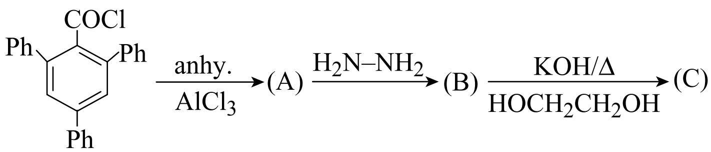
(a) 

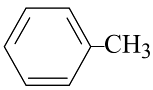
(b) 

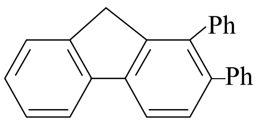
(c) 

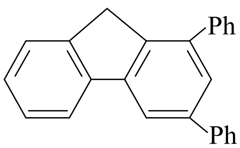
(d) 

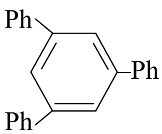
43. Identify the product (C) of the given sequence of reaction



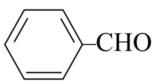
(a) 

(b) 

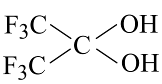
(c) 

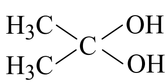
(d) 

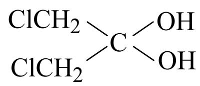
44. Which of the following gives positive Fehling's solution test

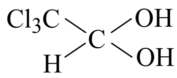
(a) HCOOH (b) HOOC–CHO (c)  (d) $\underset{\underset{O}{||}}{HC}-\underset{\underset{O}{||}}{CH}$

45. Which of the following geminal diol is most unstable?

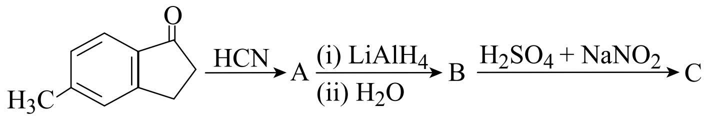
(a) 

(b) 

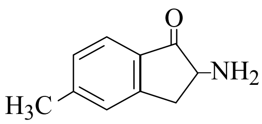
(c) 

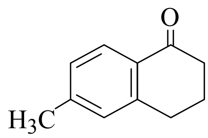
(d) 

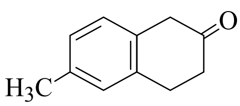
46. In the given reactions, sequence

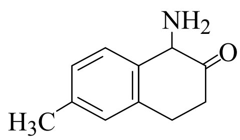


The compound C is

(a) 

(b) 

(c) 

(d) 

47. What will be the pH of an acetate-acetic acid solution when the ratio of $[CH_3CO_2^-]/[CH_3CO_2H]$ is 10? (A table of pK_a data is given below.)

(a) 5.76

(b) 4.76

(c) 3.76

(d) 1.76

Some useful	pK_a values
CH_3CO_2H	4.76
H_3PO_4	2.2
$H_2PO_4^{\ominus}$	7.2
HPO_4^{2-}	12.4

48. If the internal pH of a muscle cell is 6.8. Which one of the following statements about the concentrations of PO_4^{3-}, HPO_4^{2-}, $H_2PO_4^{1-}$, and H_3PO_4 is true?
(Hint: use the table of pK_as given in the previous question.)

(a) The species with the highest concentration is H_3PO_4.

(b) The species with the highest concentration is $H_2PO_4^{1-}$.

(c) The species with the highest concentration is PO_4^{3-}.

(d) The species with the highest concentration is HPO_4^{2-}.

49. Choose the incorrect statement about the following acid/base reactions involving propyne and its anion propynide.

	pK_a
H_2O	16
$H_3C-C\equiv CH$	25
NH_3	34

(i) $H_3C-C\equiv CH + OH^{\ominus} \rightleftharpoons H_3C-C\equiv C^{\ominus} + H_2O$

(ii) $H_3C-C\equiv CH + NH_2^{\ominus} \rightleftharpoons H_3C-C\equiv C^{\ominus} + NH_3$

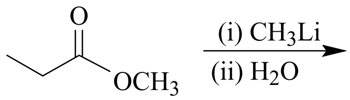
(a) The equilibrium in equation (i) lies to the left.

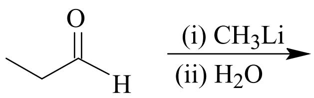
(b) The equilibrium in equation (ii) lies to the right.

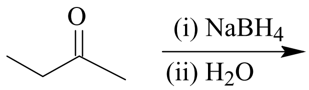
(c) In reaction (ii) ammonia, NH_3, acts as a base.

(d) Propyne, $CH_3C\equiv CH$, is a stronger acid than ammonia, NH_3.

50. Choose among the following reactions those that will give a racemic mixture of two enantiomers as the products.

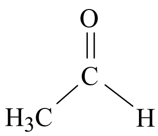
(i) 

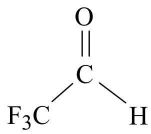
(ii) 

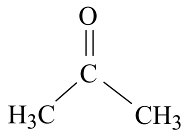
(iii) 

(a) i (b) ii (c) iii (d) ii + iii

51. Choose the order that has the following carbonyl groups correctly arranged with respect to increasing reactivity with $NaBH_4$.

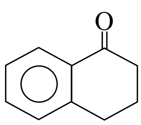
(i) 

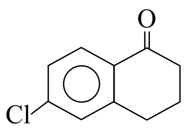
(ii) 

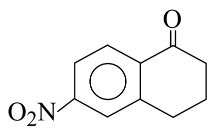
(iii) 

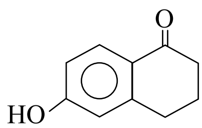
(a) i < iii < ii (increasing acidity →)
(b) i < ii < iii (increasing acidity →)
(c) ii < i < iii (increasing acidity →)
(d) iii < i < ii (increasing acidity →)

52. Which of the following is the correct order for hydrate formation of the given compounds?

(i) 

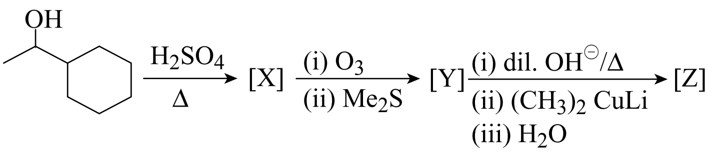
(ii) 

(iii) 

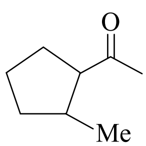
(iv) 

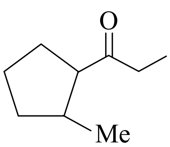
(a) i > ii > iii > iv (b) iv > i > ii > iii

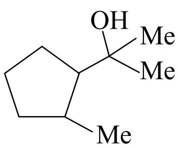
(c) iii > ii > i > iv (d) iii > i > iv > ii

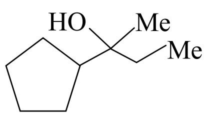
53. 

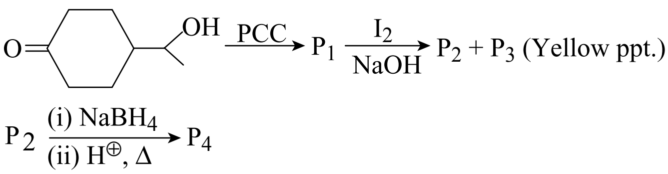
In the above sequence, compound [Z] is

(a) 

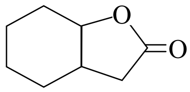
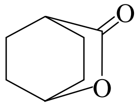
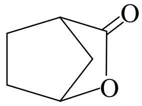
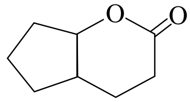
(b) 

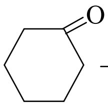
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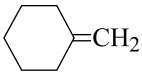
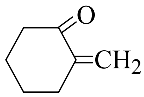
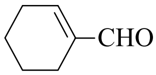
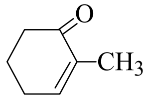
(d) 

54. 

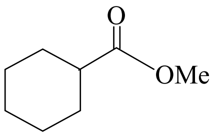
Final compound P_4 is

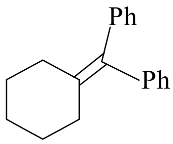
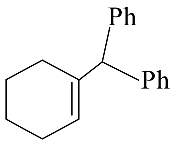
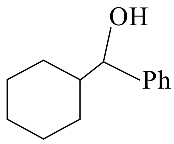
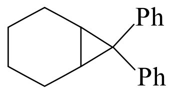
(a)  (b)  (c)  (d) 

55.  $\xrightarrow[\text{H–C(=O)–OEt}]{\overset{\oplus\ominus}{\text{NaOEt}}}$ P_1 $\xrightarrow[\text{(ii) LiAlH}_4\ \text{(iii) H}_3\text{O}^{\oplus}]{\text{(i) HO(CH}_2)_2\text{OH/HCl}}$ $P_2 \xrightarrow{\Delta} P_3$; Compound P_3 is

(a)  (b)  (c)  (d) 

56. Product "P" obtained by the reaction

 $\xrightarrow[\text{Et}_2\text{O}]{\text{PhMgBr (excess)}}$ (A) $\xrightarrow{H_2O}$ (B) $\xrightarrow[\text{heat}]{H^{\oplus}}$ Product

(a)  (b)  (c)  (d) 

57. $CH_2(CN)(NO_2) + Ph-\overset{O}{\overset{||}{C}}-H \xrightarrow[\Delta]{\text{NaOEt}}$ major products

(a) $(NC)(O_2N)C=CH-Ph$ (b) $(NC)(O_2N)C=C(OEt)(Ph)$ (c) $(NC)(O_2N)C=C(OH)(Ph)$ (d) None of these

58. Aldehydes and ketones having α-hydrogen convert into carbanion in the presence of base as follows

$$CH_3-\overset{O}{\overset{||}{C}}-R \xrightarrow{OH^-} \bar{C}H_2-\overset{O}{\overset{||}{C}}-R$$

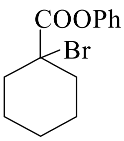
This carbanion is stable because of

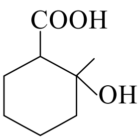
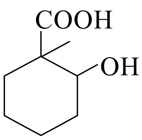
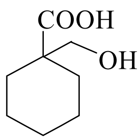
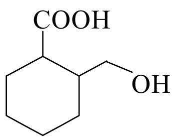
(a) Presence of -I group (–CO–)

(b) Delocalisation of negative charge by pi bond

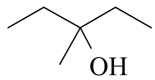
(c) Presence of +I group (i.e., R) on –CO–

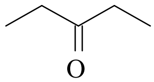
(d) Both (a) and (b)

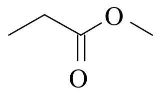
59.  $\xrightarrow[\text{(ii) CH}_2\text{O}\ \text{(iii) H}_3\text{O}^+;]{\text{(i) Zn/Et}_2\text{O}}$ A, A is

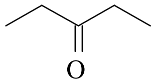
(a)  (b)  (c)  (d) 

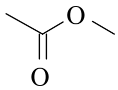
60. Choose the reaction that would not be successful for the preparation of the following alcohol.



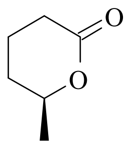
(a)  (i) CH_3MgBr (ii) NH_4Cl, H_2O →

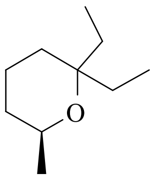
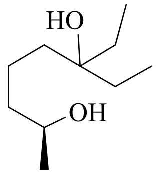
(b)  (i) CH_3MgBr (ii) NH_4Cl, H_2O →

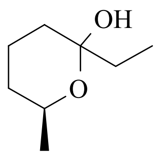
(c)  (i) CH_3CH_2MgBr →

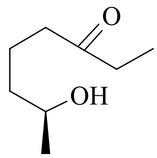
(d)  (i) CH_3CH_2MgBr (2 eq) (ii) NH_4Cl, H_2O →

61. Choose the major product of the following reaction sequence.

 (i) CH_3CH_2Li (excess) (ii) NH_4Cl, H_2O →

(a) 
(b) 

(c) 

(d) 

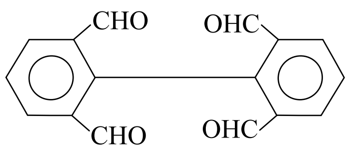
62. The compounds A, B and C in the reaction sequence

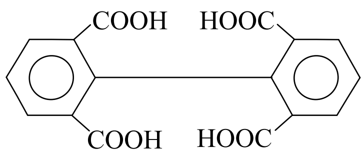
$$(CH_3)_2C{=}O \xrightarrow[\text{Alkali}]{I_2} \underset{\text{(ppt)}}{A} \xrightarrow[\Delta]{Ag} B \xrightarrow[Hg^{+2}]{\text{dil. } H_2SO_4} C$$

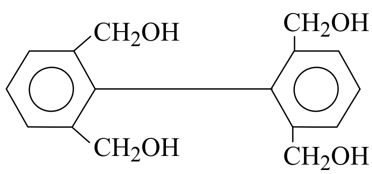
are given by the set

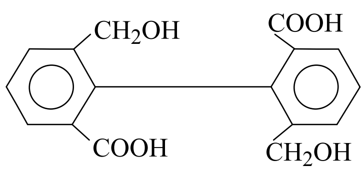
(a) Iodoform, ethylene, ethyl alcohol (b) Iodoform, acetylene, acetaldehyde

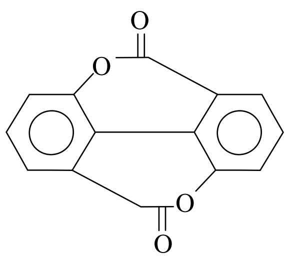
(c) Iodoform, propyne, acetone (d) Iodoform, 2-propanol, propanone

63. Any one of the product formed is by  i) Conc. NaOH ii) H^+, Δ →

(a) 

(b) 

(c) 

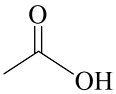
(d) 

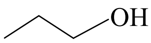
64. A compound "A" formula of $C_3H_6Cl_2$ on reaction with alkali can give "B" of formula C_3H_6O or "C" of formula C_3H_4. "B" on oxidation gave a compound of the formula $C_3H_6O_2$. "C" with dilute H_2SO_4 containing Hg^{2+} ion gave "D" of formula C_3H_6O, which with bromine and alkali gave the sodium salt of $C_2H_4O_2$. Then "A" is

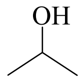
(a) $CH_3CH_2CHCl_2$ (b) $CH_3CCl_2CH_3$ (c) $CH_2ClCH_2CH_2Cl$ (d) $CH_3CHClCH_2Cl$

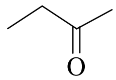
65. Identify compound [X] in the given reaction

$$\text{Me–C≡C–H} \xrightarrow[\text{dil. } H_2SO_4]{1\%\ HgSO_4} [P_1] \xleftarrow{\text{P.C.C}} \text{compound [X]}$$

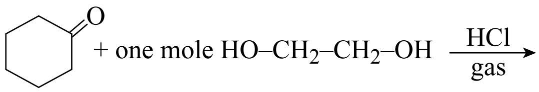
(a) 

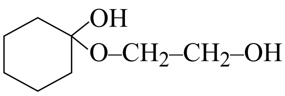
(b) 

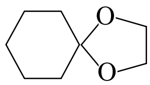
(c) 

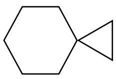
(d) 

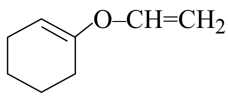
66. What is the major product obtained from the following reaction



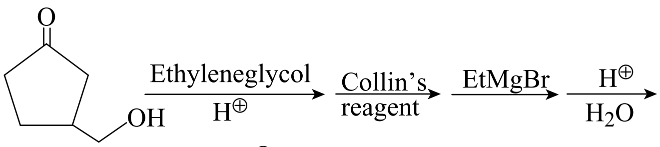
(a) 

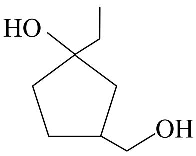
(b) 

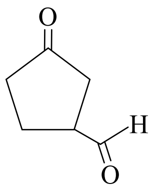
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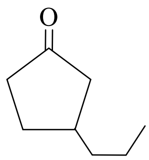
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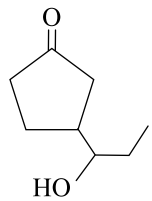
67. Give the product from the following reaction sequence



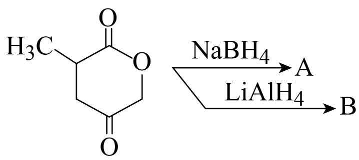
(a) 

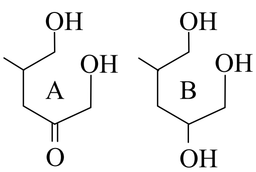
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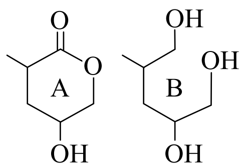
(c) 

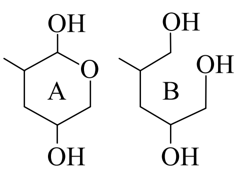
(d) 

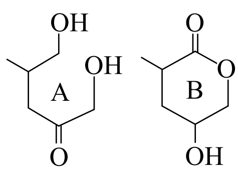
68. Predict the major organic product from the following reaction

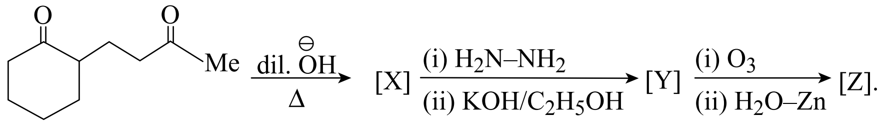


(a) 

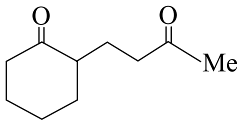
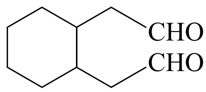
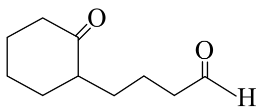
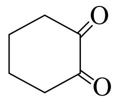
(b) 

(c) 

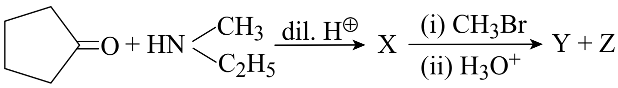
(d) 

69. 

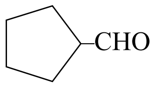
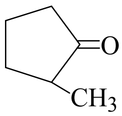
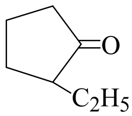
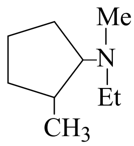
The product (Z) is

(a)  (b)  (c)  (d) 

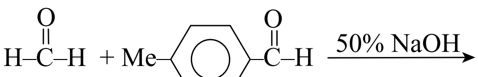
70. The final product (Y) of the following reaction sequence is



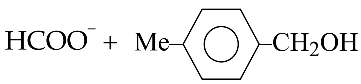
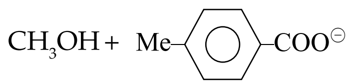
Z + Hinsberg reagent $\longrightarrow$ $\xrightarrow{\text{KOH}}$ (No dissolution/solid residue)

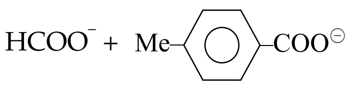
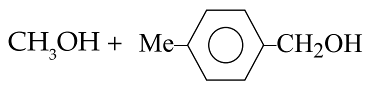
(a)  (b)  (c)  (d) 

71. In the given reaction

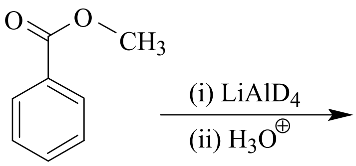
 A + B (A and B are cross Cannizaro product);

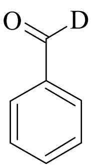
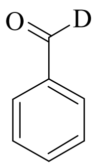
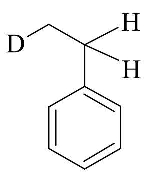
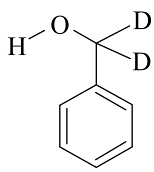
A and B are

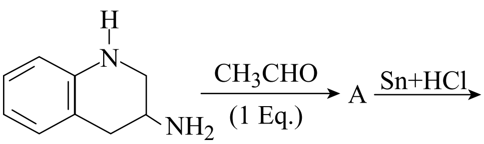
(a)  (b) 

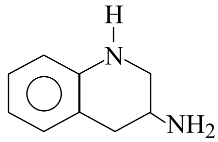
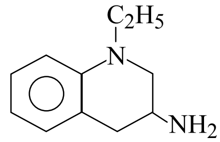
(c)  (d) 

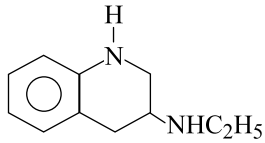
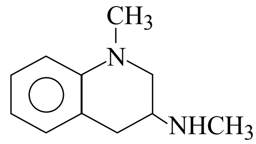
72. Choose the major product of the following reaction.



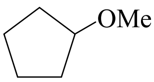
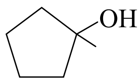
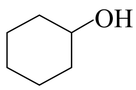
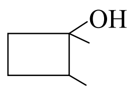
(a)  (b)  (c)  (d) 

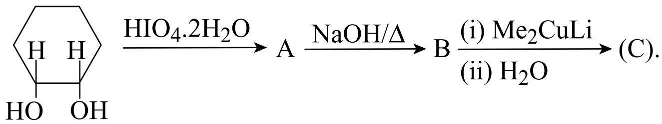
73.  B. B is

(a) 
(b) 

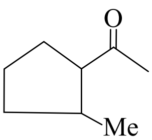
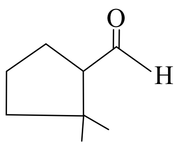
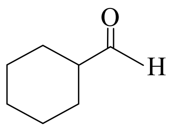
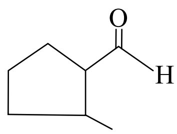
(c) 
(d) 

74. An organic compound A($C_6H_{12}O$) neither decolourise bromine water nor changes the colour of acidic dichromate solution. A on heating with H_2SO_4 produces an alkene which on oxidative ozonolysis gives B($C_6H_{10}O_3$), which gives an yellow precipitate with NaOH/I_2. The most probable structure of A is

(a) 
(b) 
(c) 
(d) 

75. 

Identify "(C)" product

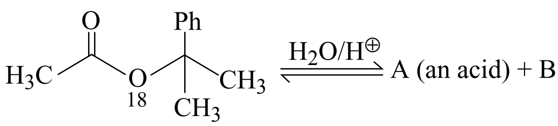
(a) 
(b) 
(c) 
(d) 

76. In the given reaction

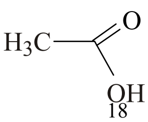
$$CH_3–CH_2–COOH \xrightarrow{Br_2/PBr_3} \xrightarrow[(alc.)]{NH_3} (A)$$

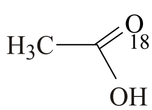
(a) would be

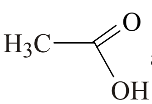
(a) $CH_3–CH_2–\overset{O}{\overset{\|}{C}}–Br$ (b) $CH_3–\underset{NH_2}{\underset{|}{CH}}–\overset{O}{\overset{\|}{C}}–OH$ (c) $CH_3–\underset{Br}{\underset{|}{CH}}–COOH$ (d) $CH_3–\underset{NH_2}{\underset{|}{CH}}–\overset{O}{\overset{\|}{C}}–NH_2$

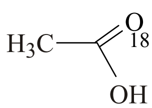
77. 

where A and B are, respectively

(a)  and $Me–\overset{Ph}{\overset{|}{C}}–OH$ with Me below C

(b)  and $Me–\overset{Ph}{\overset{|}{C}}–\overset{18}{O}H$ with Me below C

(c)  and $Me–\overset{Ph}{\overset{|}{C}}–\overset{18}{O}H$ with Me below C

(d)  and $Me–\overset{Ph}{\overset{|}{C}}–\overset{18}{O}H$ with Me below C

78. $CH_3-\underset{}{CH}(NH_2)-COOH$ can be converted into $CH_3-CH(NH_2)-CH_2OH$ by the use of

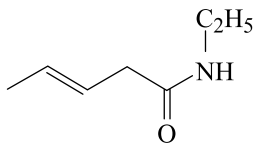
(a) H_2/Pd (b) $LiAlH_4$ (c) $NaBH_4$ (d) CH_3MgBr

79. Arrange in increasing order of reactivity towards nucleophile

(i) $H_3C-\overset{O}{\overset{\|}{C}}-NH_2$ (ii) $CH_3-\overset{O}{\overset{\|}{C}}-Cl$ (iii) $CH_3-\overset{O}{\overset{\|}{C}}-OAc$ (iv) $H_3C-\overset{O}{\overset{\|}{C}}-OCH_3$

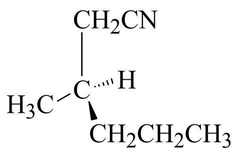
(a) ii > iv > i > iii (b) ii > iii > iv > i
(c) iii > ii > i > iv (d) iii > iv > ii > i

80. What is the name of the following compound?



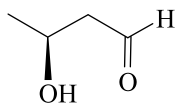
(a) trans-N-ethyl-3-pentenamide (b) trans-1-ethyl-3-pentenamide
(c) trans-N-ethyl-4-pentenamide (d) trans-1-ethyl-4-pentenamide

81. What is the name of the following compound?



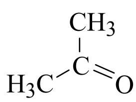
(a) (R)-3-methylhexaneamine (b) (S)-3-methylhexaneamine
(c) (R)-3-methylhexanenitrile (d) (S)-3-methylhexanenitrile

82. What is the name of the following compound?



(a) (R)-3-hydroxybutanal (b) (S)-3-hydroxybutanal
(c) (R)-3-hydroxybutanol (d) (S)-3-hydroxybutanol

83. What is not the name of the following compound?

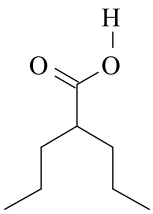


(a) acetone (b) dimethyl ketone (c) 2-oxoketone (d) propanone

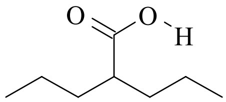
84. Which of the following compound has the highest boiling point?

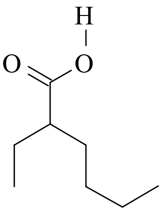
(a) $CH_3CH_2CH_3$ (b) CH_3CO_2H (c) CH_3COCH_3 (d) CH_3CH_2OH

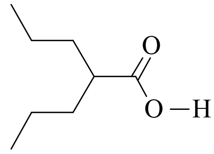
85. Valproic acid found clinical use as an anticonvulsant and mood-stabilizing drug that has proven useful in the treatment of epilepsy, bipolar disorder, and other problems. Choose the constitutional isomer(s) of valproic acid.



valproic acid

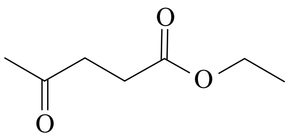
(i) 

(ii) 

(iii) 

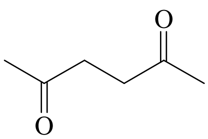
(a) i (b) ii (c) iii (d) i and ii

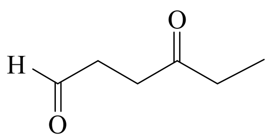
86. What is the name of the following compound?

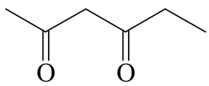


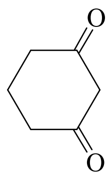
(a) ethyl 4-oxopentanoate
(b) ethyl ester methyl ketone
(c) ethyl 4-ketonepentanoate
(d) ethyl 4-ketone pentyl ester

87. What is the structure of 2,4-hexanedione?

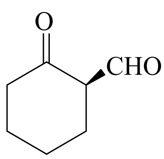
(a) 

(b) 

(c) 

(d) 

88. What is the name of the following compound?

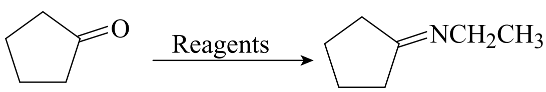


(a) (R)-2-ketocyclohexane carbaldehyde
(b) (R)-2-aldehydecyclohexanone
(c) (S)-2-formylcyclohexanone
(d) (S)-2-aldehydecyclohexanone

89. If only one equivalent of NH_3 (one mole of NH_3 reacts with one mole of cyclohexyl chloride) was used, the reaction may not go to completion. Why?

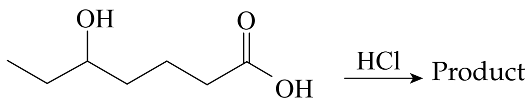
(a) NH_3 is not a strong nucleophile. Therefore, more NH_3 is needed.
(b) Cl is not a good leaving. Therefore, more NH_3 is needed.
(c) Cyclohexyl group presents large steric hindrance. Therefore, more NH_3 is needed.
(d) NH_3 will be protonated by HCl as reaction proceeds. Therefore, the reaction will be incomplete.

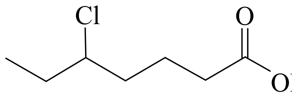
90. What could be the best reagents for the following reaction?

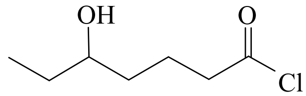


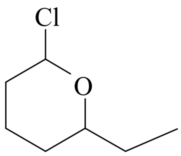
(a) H_2NEt and CH_3CO_2H (b) H_2NEt and HCl
(c) H_2NEt and NaOH (d) H_2NEt and $Na^+{-}OCH_3$

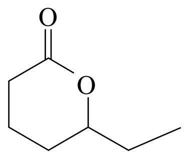
91. What could be the product for the following reaction?



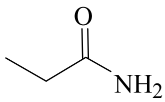
(a) 

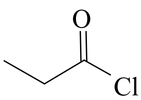
(b) 

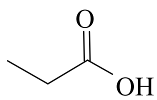
(c) 

(d) 

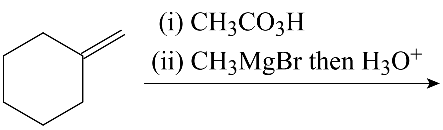
92. What is the order of increasing boiling points (from the lowest to highest) for the following compounds?

(i) 

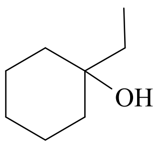
(ii) 

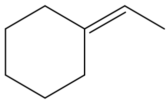
(iii) 

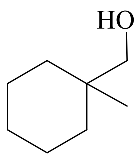
(a) ii, i, iii (b) ii, iii, i (c) i, iii, ii (d) iii, i, ii

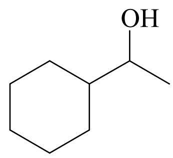
93. 

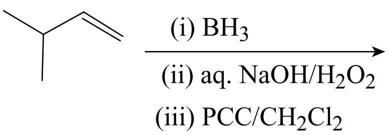
product is

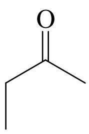
(a) 

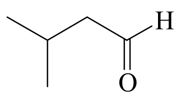
(b) 

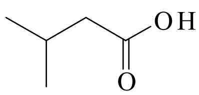
(c) 

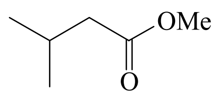
(d) 

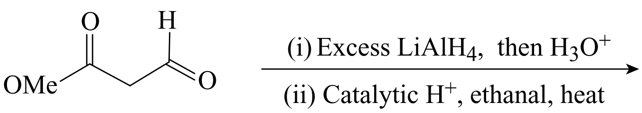
94. 

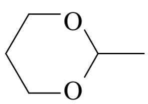
(a) 

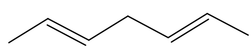
(b) 

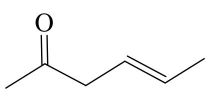
(c) 

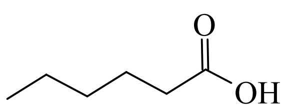
(d) 

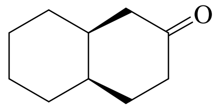
95. 

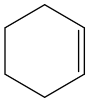
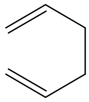
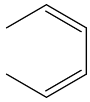
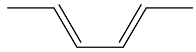
(a) 

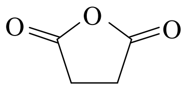
(b) 

(c) 

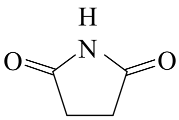
(d) 

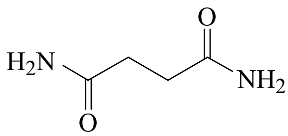
96. ? (i) 1, 3-butadiene, heat (ii) $Hg(OAC)_2$, H_2O (iii) $NaBH_4$ (iv) PCC → 

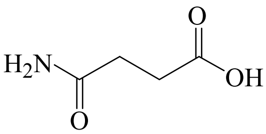
(a)  (b)  (c)  (d) 

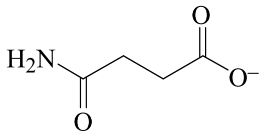
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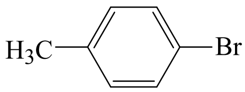
Aqueous NH_3 →

(a) 

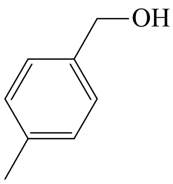
(b) 

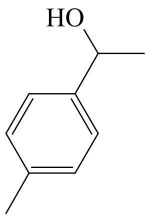
(c) 

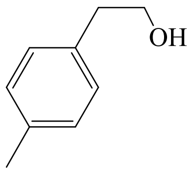
(d) 

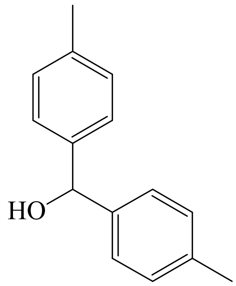
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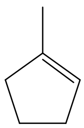
(excess) (i) Mg, Ether (ii) Methyl ethanote, then H_3O^+ → ?

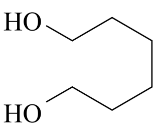
(a) 

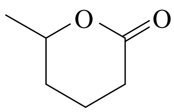
(b) 

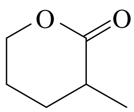
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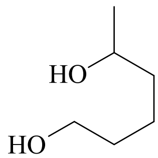
(d) 

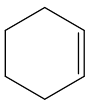
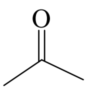
99.  (i) O_3, then H_2O_2 (ii) $NaBH_4$ (iii) Catalytic H_+ → ?

(a) 

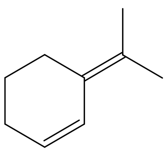
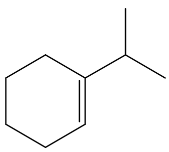
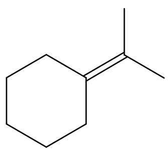
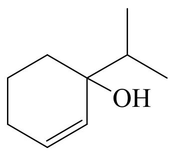
(b) 

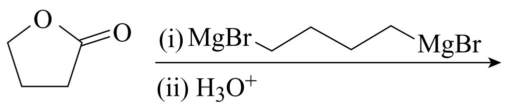
(c) 

(d) 

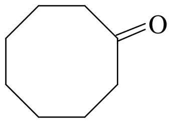
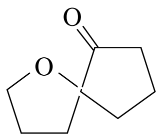
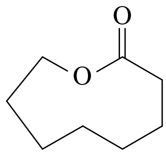
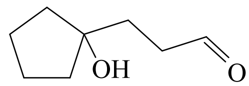
100.  (i) Br_2/UV light (ii) Ph_3P, then $CH_3CH_2CH_2CH_2Li$ (iii) 

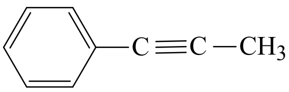
→

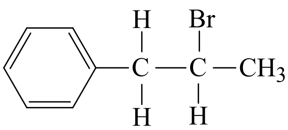
(a)  (b)  (c)  (d) 

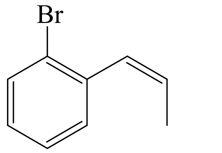
101. 

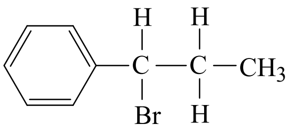
(ii) H_3O^+
(iii) PCC

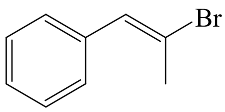
(a)  (b)  (c)  (d) 

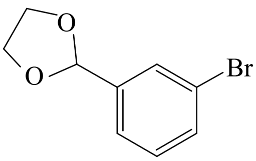
102.  $\xrightarrow[\text{(ii) HBr}]{\text{(i) Na, NH}_3}$ product is

(a) 

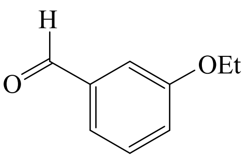
(b) 

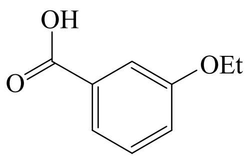
(c) 

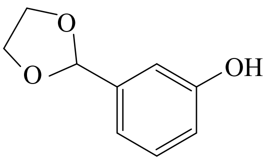
(d) 

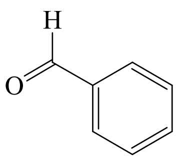
103. 

(i) Mg, Ether
(ii) EtOH
(iii) Catalytic H^+, H_2O

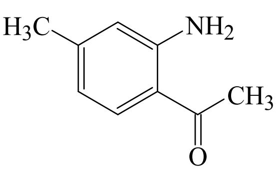
(a) 

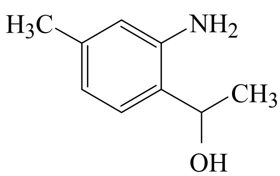
(b) 

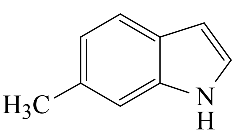
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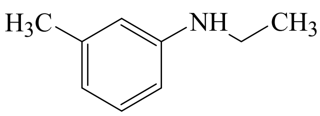
(d) 

104. CH_3CO_2H $\xrightarrow{\text{(i) SOCl}_2}$
(ii) 3-methylaniline
(iii) $LiAlH_4$, then H_3O^+

(a) 

(b) 

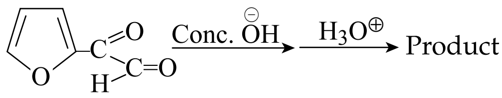
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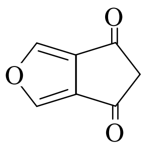
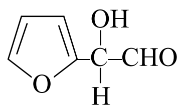
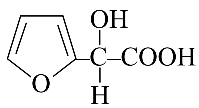
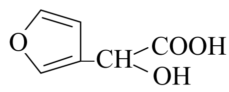
(d) 

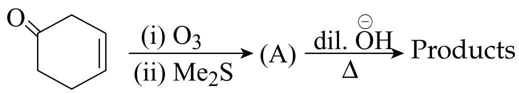
LEVEL 2

Single and Multiple-choice Type

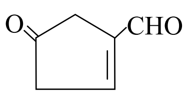
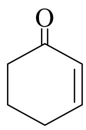
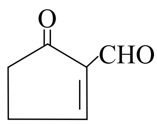
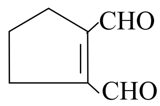
1. The product is

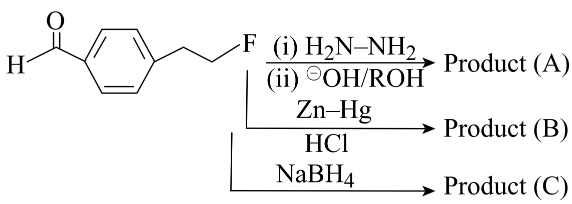


(a)  (b)  (c)  (d) 

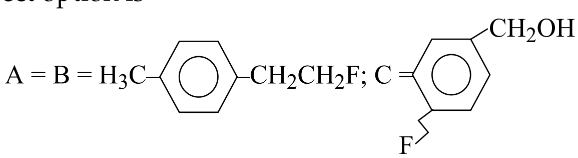
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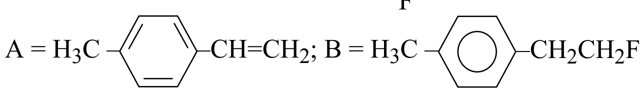
In the above sequence the final products of the reaction is/are

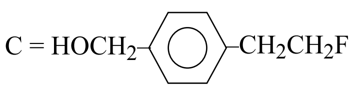
(a)  (b)  (c)  (d) 

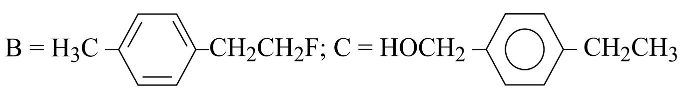
3. 

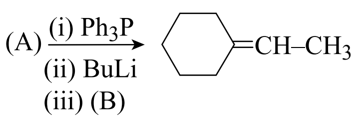
Correct option is

(a) 

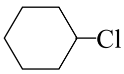
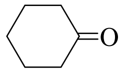
(b) 

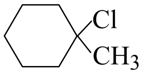
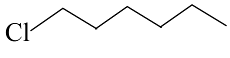
(c) 

(d) 

4. 

In the above reaction, (A) and (B) will respectively be

(a)  and CH_3CHO (b) CH_3CH_2Cl and 

(c)  and HCHO (d)  and CH_3CHO

5. Which of the following pairs will form the same product with phenyl hydrazine/$H^{\oplus}$?

(a) $CH_2OH–CO–CH_3$ and $CHO–CHOH–CH_3$

(b) Glucose and mannose

(c) Glucose and fructose

(d) Glucose and sucrose

6. Which is/are untrue statement(s)?

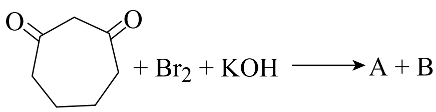
(a) Protonation increases electrophilic nature of carbonyl group

(b) $CF_3SO_3^-$ is a better leaving group than $CH_3SO_3^-$

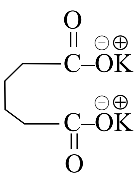
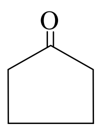
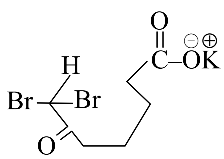
(c) Benzyl carbonium ion is stabilised by resonance

(d) $CCl_3CH(OH)_2$ is unstable

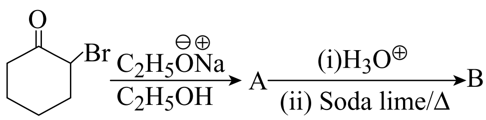
7. Identify the product in the following reaction



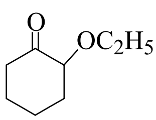
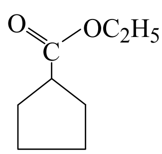
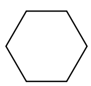
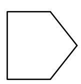
A and B are

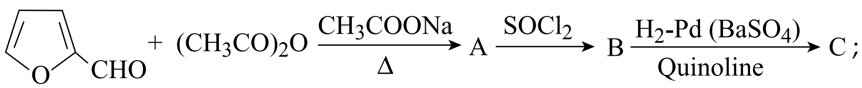
(a) $CHBr_3$ (b)  (c)  (d) 

8. In the following reaction

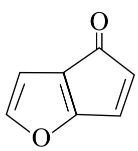
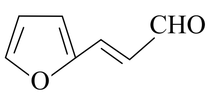
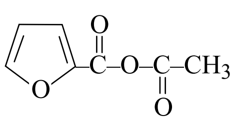
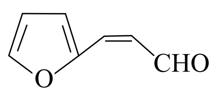


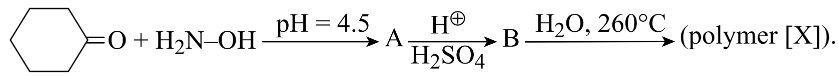
Product A and B are

(a)  (b)  (c)  (d) 

9. 

Product (C) is/are

(a)  (b)  (c)  (d) 

10. 

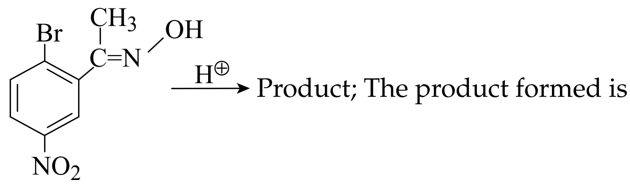
Correct statements about [X] are

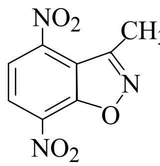
(a) the polymer is bakelite

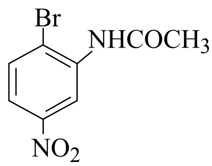
(b) the polymer is Nylon-6

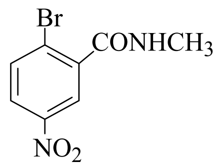
(c) the polymer contains six carbon atoms in the repeating units

(d) it is condensation polymer(s)

11. 

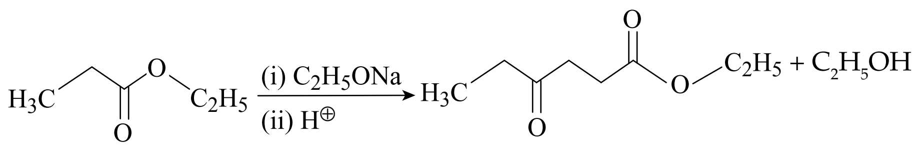
(a) 

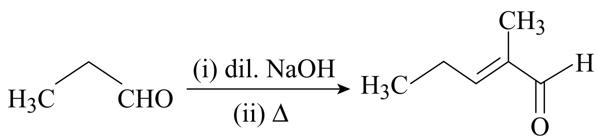
(b) 

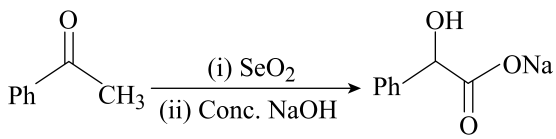
(c) 

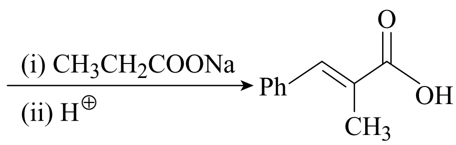
(d) None of these

12. Select the correct reactions

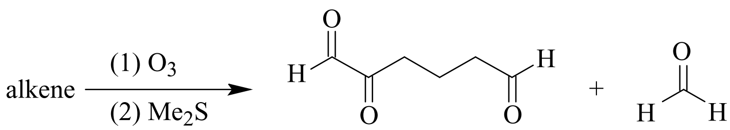
(a) 

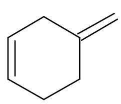
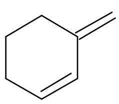
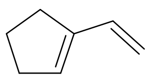
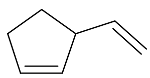
(b) 

(c) 

(d) PhCHO + $(CH_3CH_2CO)_2O$ 

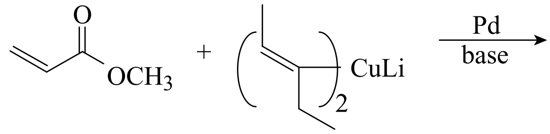
13. Choose the alkene(s) that would give the two products of the following ozonolysis reaction.



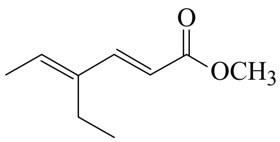
(i)  (ii)  (iii)  (iv) 

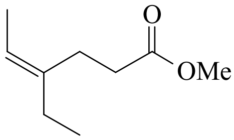
(a) i (b) ii (c) ii and iii (d) iii and iv

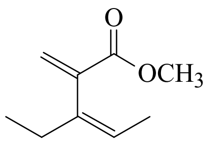
14. Choose the major product of the following reaction

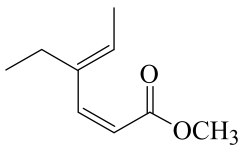


Major product?

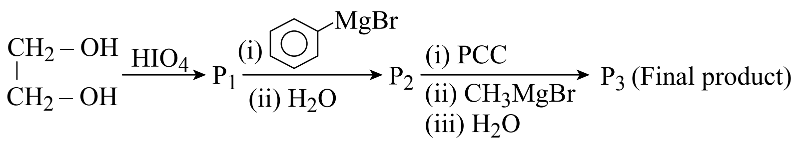
(a) 

(b) 

(c) 

(d) 

15. Which of the following is correct for the final product of the given sequence of reaction



(a) Compound P_3 on oxidation with $(CrO_3 + H_2SO_4)$ gives a compound which gives 2, 4 DNP test

(b) Compound P_3 on reaction with I_2 + NaOH gives yellow ppt

(c) Compound P_3 on reaction with cerric ammonium nitrate gives red colouration

(d) Compound P_3 on reaction with MnO_2 gives carboxylic acid

16. Identify correct method of preparation of acetaldehyde from reaction of cyanide

(a) $Me-C\equiv N \xrightarrow[\text{(ii) } H_3O^+]{\text{(i) DIBAL}}$

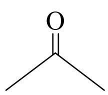
(b) $Me-C\equiv N \xrightarrow[\text{(ii) } H_3O^+]{\text{(i) } SnCl_2 + HCl}$

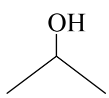
(c) $Me-C\equiv N \xrightarrow[\text{(ii) dill. NaOH}]{\text{(i) Conc. } H_2SO_4}$

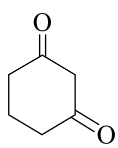
(d) $Me-C\equiv N \xrightarrow[\text{(ii) } H_3O^{\oplus}]{\text{(i) Pd/BaSo}_4 / H_2}$

17. Identify compounds that give iodoform test

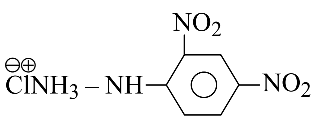
(a) $Me-\overset{\overset{\displaystyle O}{\|}}{C}-OPh$

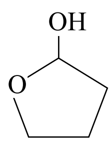
(b) 

(c) 

(d) 

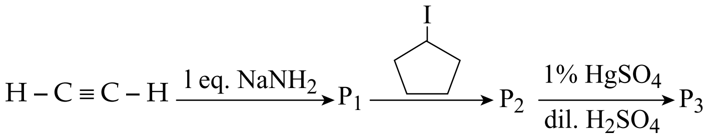
18. Identify compounds which give PPT with Tollen's reagent

(a) 

(b) 

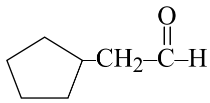
(c) $Me-C\equiv C-H$

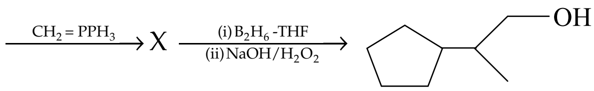
(d) $Me-\overset{\overset{\displaystyle O}{\|}}{C}-H$

19. 

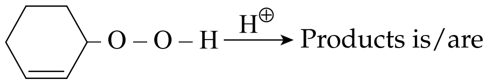
Identify the correct statement for the above reaction sequence?

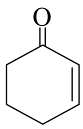
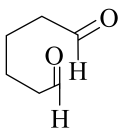
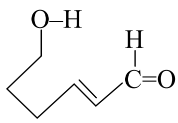
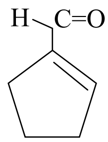
(a) P_3 – Product gives +ve iodoform test

(b) P_2 – Product on reaction with $HB(Sia)_2$ and $H_2O_2/OH^{\ominus}$ gives 

(c) P_3 – Product 

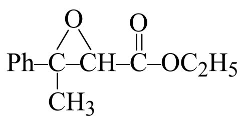
(d) P_3 – Product gives Tollen's test

20. 

(a)  (b)  (c)  (d) 

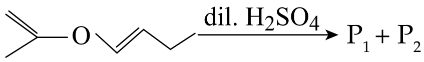
21. $Ph-\overset{O}{\overset{\|}{C}}-CH_3 + \underset{Br}{\underset{|}{CH_2}}-\overset{O}{\overset{\|}{C}}-O-C_2H_5 \xrightarrow{NaNH_2} A \xrightarrow[H^+/\Delta]{KOH/H_2O} B$; Products A and B are

(a) $Ph-\overset{O}{\overset{\|}{C}}-CH_2-CH_2-\overset{O}{\overset{\|}{C}}-NH_2$

(b) 

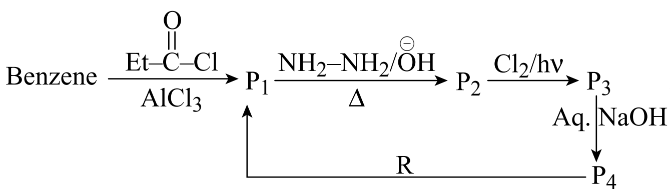
(c) $Ph-CH_2-\overset{O}{\overset{\|}{C}}-CH_3$

(d) $Ph-\underset{CH_3}{\underset{|}{CH}}-\overset{O}{\overset{\|}{C}}-H$

22. 

P_1 and P_2 products are identified by

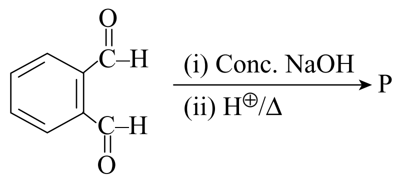
(a) Tollen's reagent (b) Iodoform test (c) $Br_2 + H_2O$ test (d) 1% alkaline $KMnO_4$

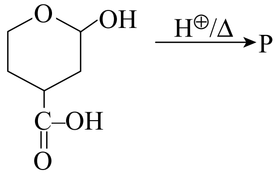
23.  ; Regent "R" is

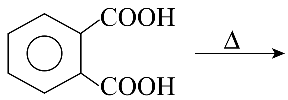
(a) MnO_2/Δ (b) P.C.C. (c) $Br_2 + H_2O$ (d) LAH

24. Among the following reactions identify lactonisation reactions

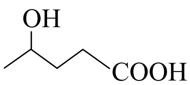
(a) $Me-\overset{\overset{O}{\|}}{C}-H \xrightarrow[(2)\ EtOH/H^{\oplus}]{(1)\ CrO_3\cdot H_2O} P$

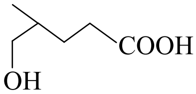
(b) 

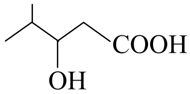
(c) 

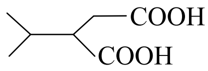
(d) 

25. The compound which gives lactone on heating or in the presence of Conc. $H^{\oplus}$ medium

(a) 

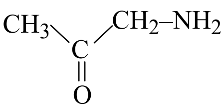
(b) 

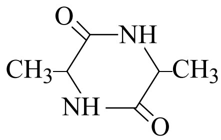
(c) 

(d) 

26. The products Y and X are

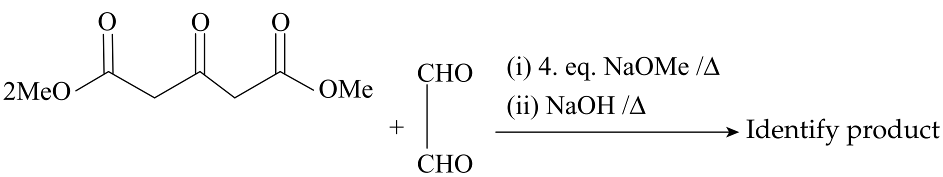
$$CH_3-CH_2COOH \xrightarrow[\text{Red P}]{Br_2} \xrightarrow[\text{(alc.)}]{NH_3} [X] \xrightarrow[\Delta]{H^{\oplus}} [Y]$$

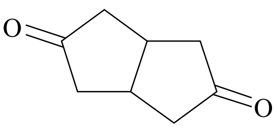
(a) 

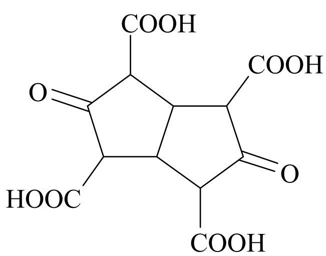
(b) 

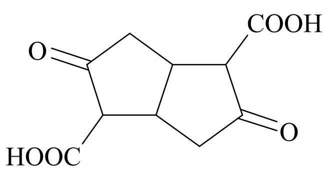
(c) $C_2H_5-\overset{\overset{O}{\|}}{C}-NH_2$

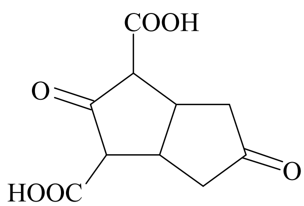
(d) $CH_3-\underset{\underset{COOH}{|}}{CH}-NH_2$

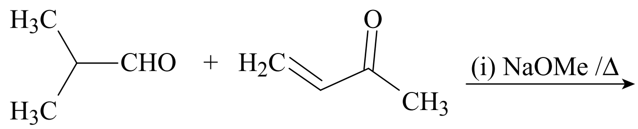
27. 

(a) 

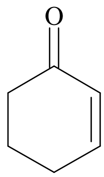
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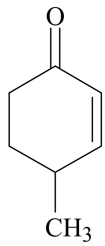
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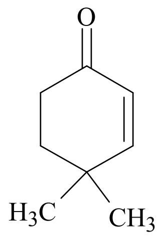
(d) 

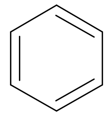
28. 

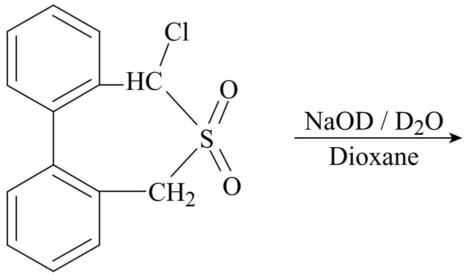
Identify product

(a) 

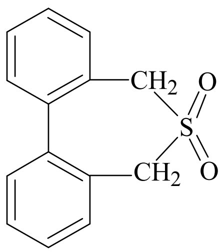
(b) 

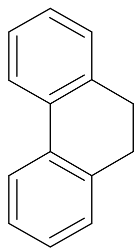
(c) 

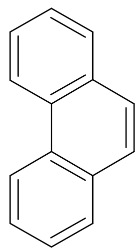
(d) 

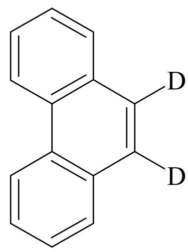
29. 

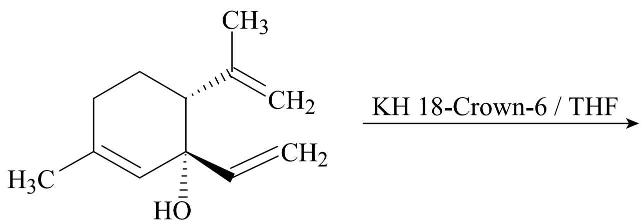
Identify product

(a) 

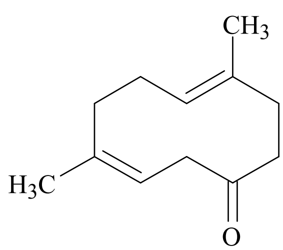
(b) 

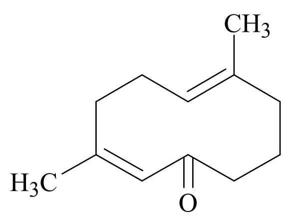
(c) 

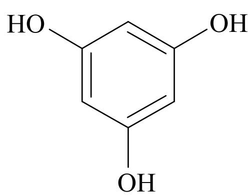
(d) 

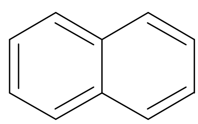
30. 

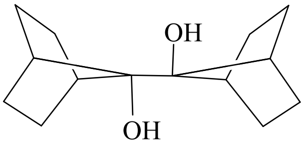
Identify product

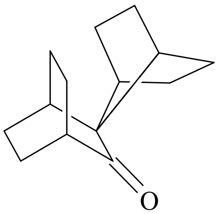
(a) 

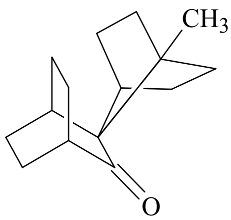
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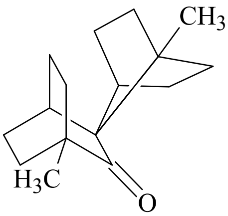
(c) 

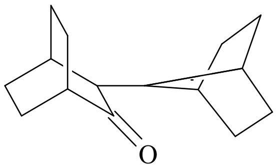
(d) 

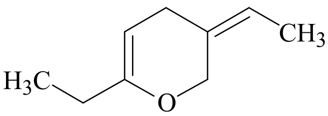
31.  $\xrightarrow{\text{Conc. } H_2SO_4}$ Identify product

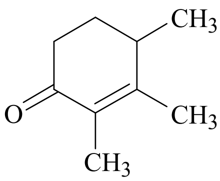
(a) 

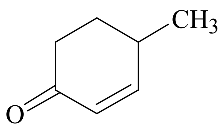
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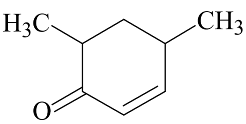
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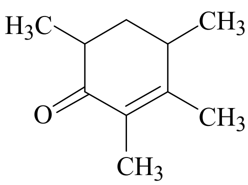
(d) 

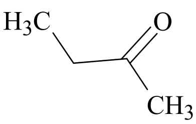
32.  $\xrightarrow{\text{Conc. } H_2SO_4}$ Identify product

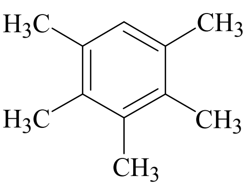
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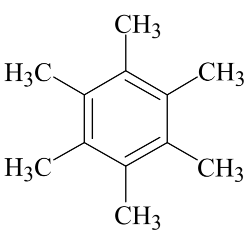
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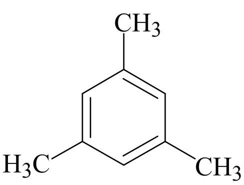
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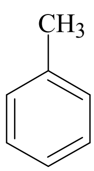
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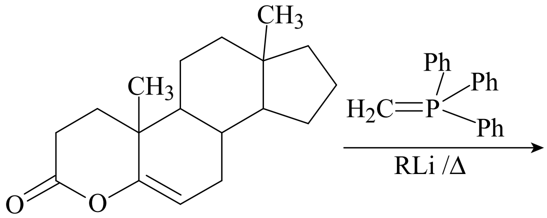
33.  $\xrightarrow{\text{Conc. } H_2SO_4}$ Identify product

(a) 

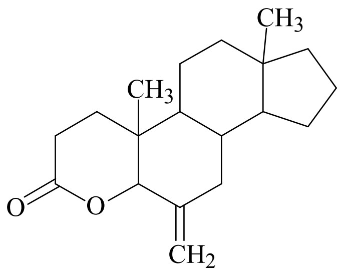
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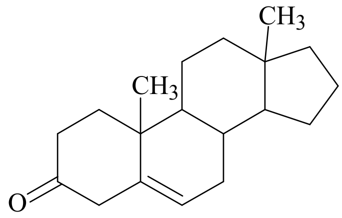
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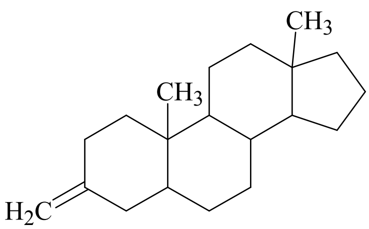
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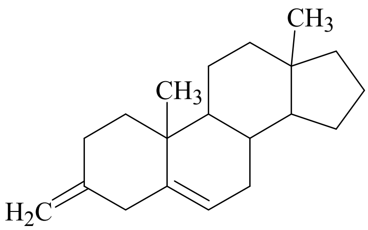
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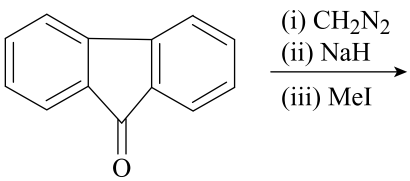
Identify product

(a) 

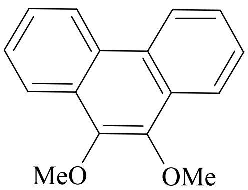
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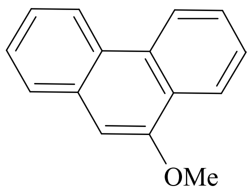
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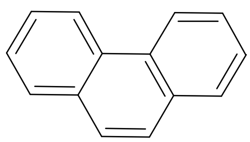
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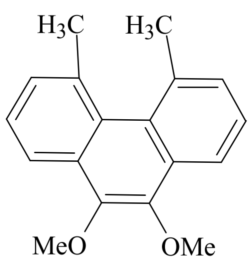
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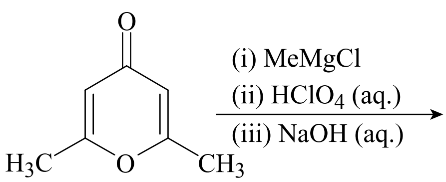
Identify product

(a) 

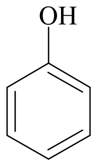
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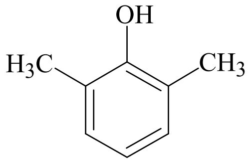
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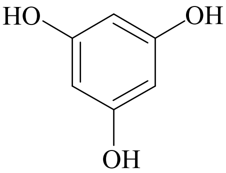
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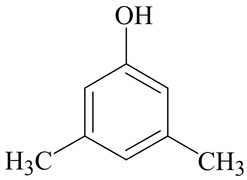
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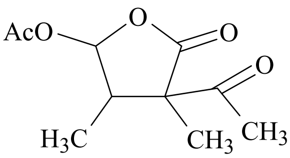
Identify product

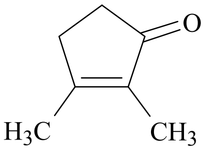
(a) 

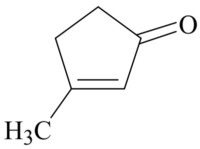
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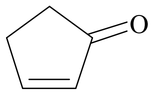
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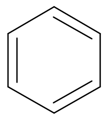
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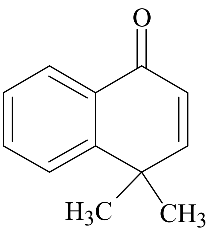
37.  $\xrightarrow{\text{Aq. NaOH }/\Delta}$ Identify product

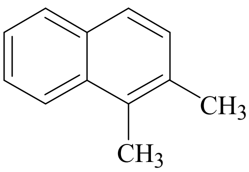
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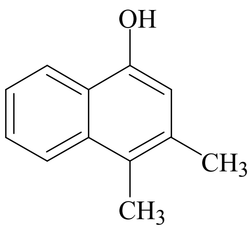
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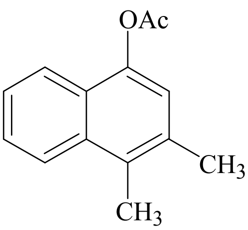
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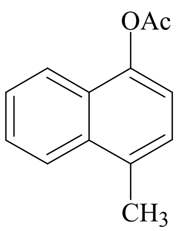
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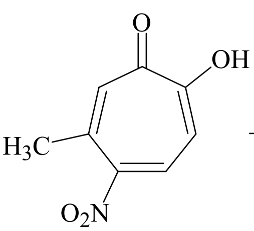
38.  $\xrightarrow{Ac_2O}$ Identify product

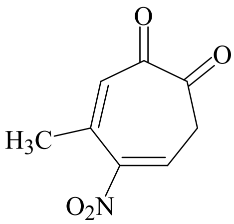
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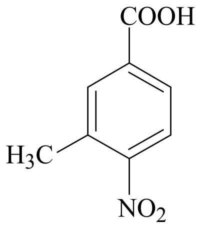
(b) 

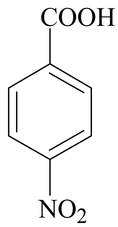
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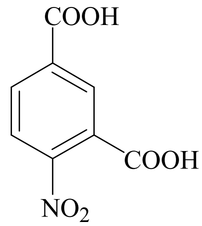
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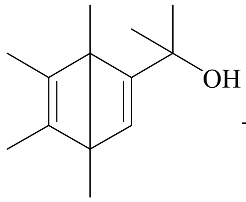
39.  $\xrightarrow{NaOH}$ Identify product

(a) 

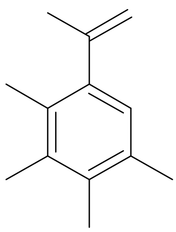
(b) 

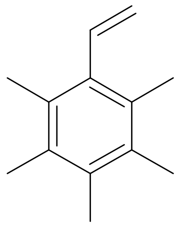
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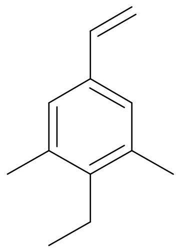
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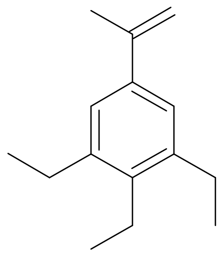
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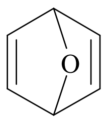
$\xrightarrow{\text{Conc. } H_2SO_4/\Delta}$ Identify product

(a) 

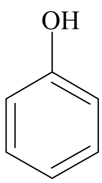
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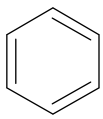
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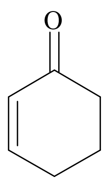
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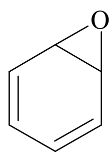
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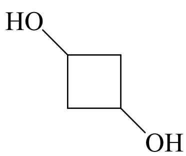
$\xrightarrow{\text{Conc. } H_2SO_4/\Delta}$ Identify product

(a) 

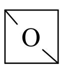
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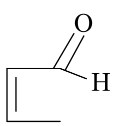
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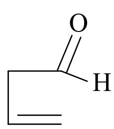
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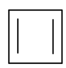
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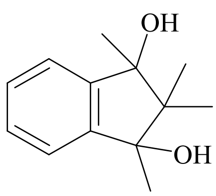
$\xrightarrow{\text{Conc. } H_2SO_4/\Delta}$ Identify major product

(a) 

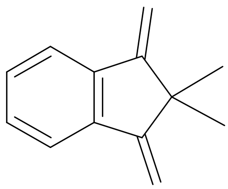
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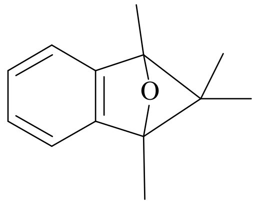
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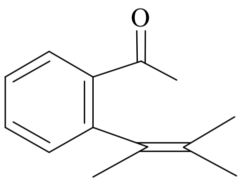
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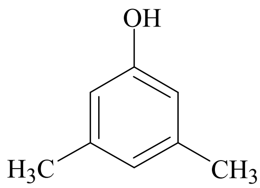
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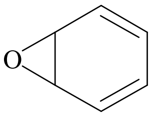
$\xrightarrow{\text{Conc. } H_2SO_4/\Delta}$ Identify major product

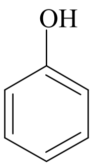
(a) 

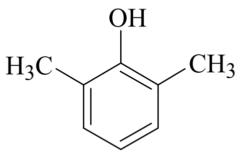
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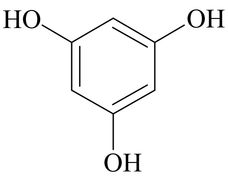
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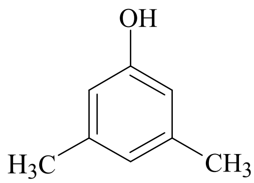
(d) 

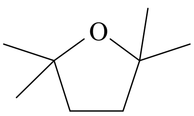
44.  $\xrightarrow{\text{Conc. } H_2SO_4/\Delta}$ Identify product

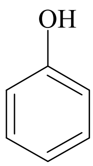
(a) 

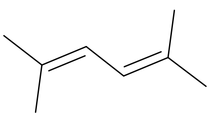
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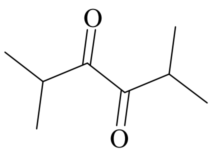
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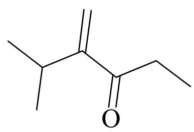
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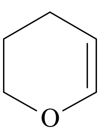
45.  $\xrightarrow{\text{Conc. } H_2SO_4/\Delta}$ Identify product

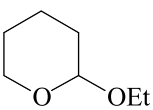
(a) 

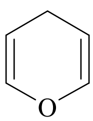
(b) 

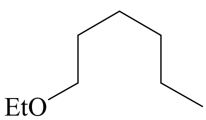
(c) 

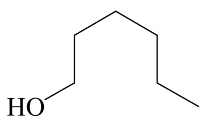
(d) 

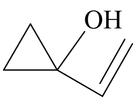
46.  $\xrightarrow[\text{EtOH}]{\text{Conc. } H_2SO_4}$ Identify product

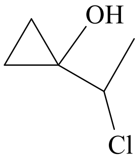
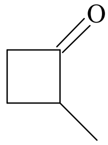
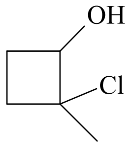
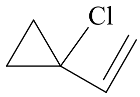
(a) 

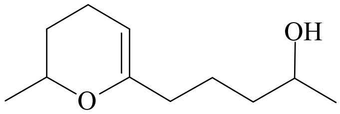
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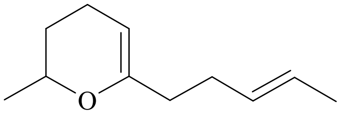
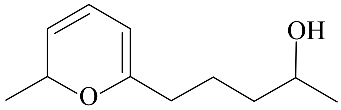
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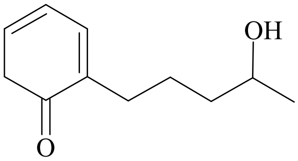
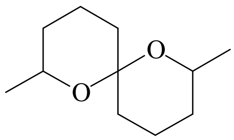
(d) 

47.  $\xrightarrow{\text{Conc. HCl}}$ Identify product

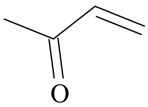
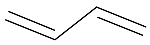
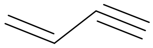
(a)  (b)  (c)  (d) 

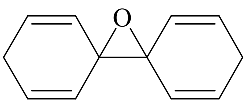
48.  $\xrightarrow{\text{Conc. } H_2SO_4/\Delta}$ Identify product

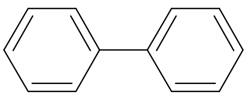
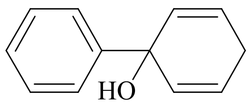
(a)  (b) 

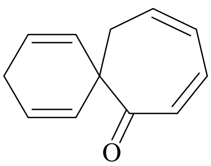
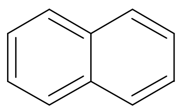
(c)  (d) 

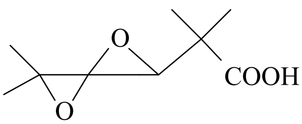
49. $H_3C-C\equiv C-CH_2-OH$ $\xrightarrow{\text{Dil. } H_2SO_4}$ Identify product

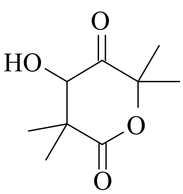
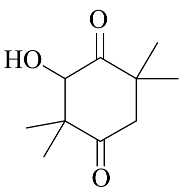
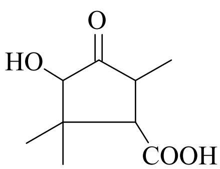
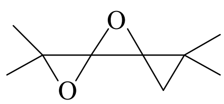
(a) $HO-CH_2-C\equiv C-CH_2-OH$ (b)  (c)  (d) 

50.  $\xrightarrow{\text{Conc. } H_2SO_4/\Delta}$ Identify product

(a)  (b) 

(c)  (d) 

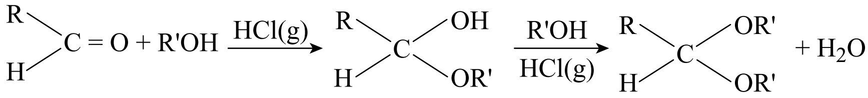
51.  $\xrightarrow{\Delta}$ Product is?

(a)  (b)  (c)  (d) 

Comprehension Type

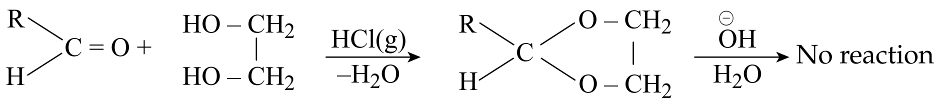
Passage 1

If we take an alcohol solution of an aldehyde (or ketone) and pass into it a small amount of gaseous HCl the hemiacetal forms, and hemiacetal reacts with a second molar equivalent of the alcohol to produce an acetal (or ketal).

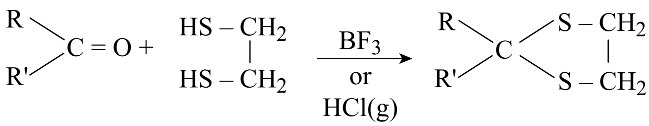


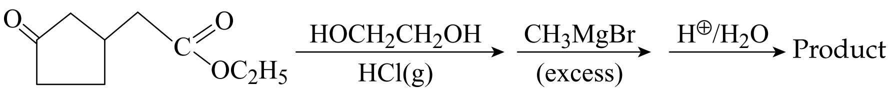
All the steps in the formation of an acetal from an aldehyde (or ketone) are reversible. With excess of alcohol, equilibrium favours forward (acetal formation) direction.

Although acetals are hydrolysed to aldehydes and ketones in aqueous acid, they are stable in basic solution. Because of this property, it is a convenient method for protecting aldehyde and ketone from a series reaching in basic solution.

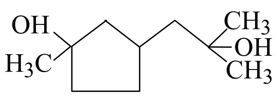


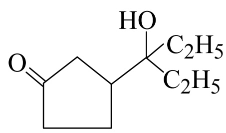
Similarily, thioacetal (ketal) formation takes place.

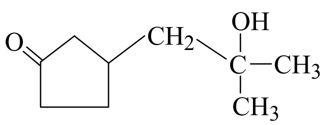


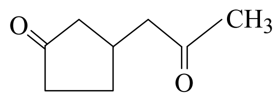
52. 

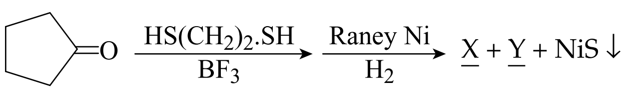
The final product of the reaction is

(a) 

(b) 

(c) 

(d) 

53. 

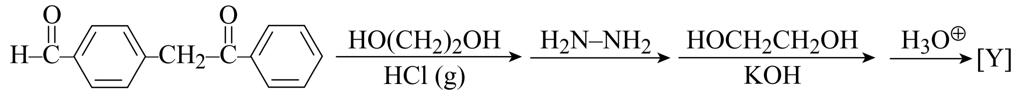
Correct statement for the given reaction is

(a) X and Y are structural isomers

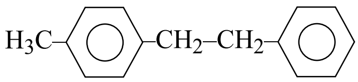
(b) both X and Y gives only one monochlorinated product

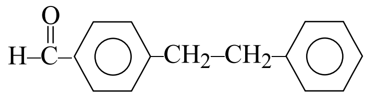
(c) X on oxidative ozonolysis gives gluteric acid

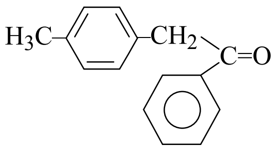
(d) X and Y on reaction with H_2N-OH gives oxime

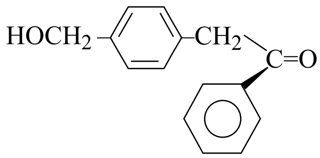
54. 

The product (Y) is

(a) 

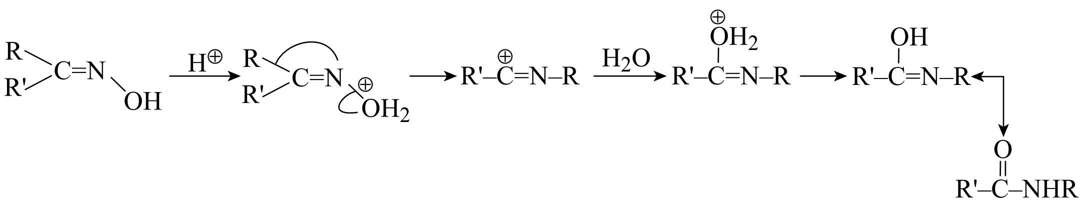
(b) 

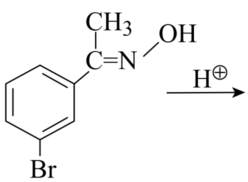
(c) 

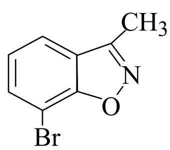
(d) 

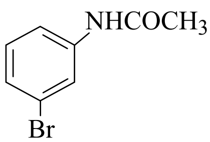
Passage 2

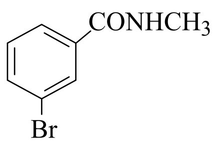
In organic chemistry various reactions take palce by rearrangements. These rearrangements can be classified on the basis of migratory group and its nature. One of the well-known rearrangement is the formation of N-substituted amides by rearrangement of aldoximes or ketoximes. This is known as Beckmann rearrangement. It is catalysed by various acidic reagents. The mechanism of this reaction is given as



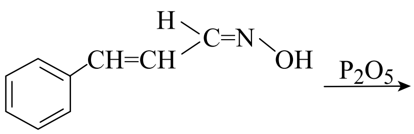
55.  Product; The product formed is

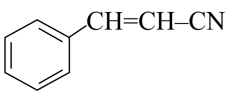
(a) 

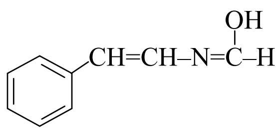
(b) 

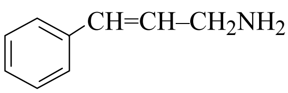
(c) 

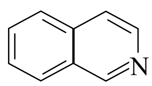
(d) none of these

56.  Product; The final product is

(a) 

(b) 

(c) 

(d) 

57. $(CH_3)(C_2H_5)C{=}NOH \xrightarrow{C_6H_5SO_2Cl} (A) \xrightarrow{H_2O/H^{\oplus}} CH_3NH_2 + C_2H_5COOH$

The formation of final product suggest the migration of

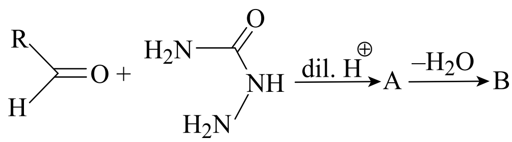
(a) $-CH_3$ group (b) $-C_2H_5$ group

(c) $C_6H_5-SO_2-$group (d) cannot predicated without structure

Passage 3

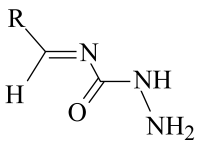
Aldehydes and ketones show nucleophilic addition reactions. The α-hydrogens in aldehydes and ketones are acidic. Therefore, aldehydes and ketones having at least one α-H undergo aldol condensation in the presence of a base such as NaOH. Aldehydes having no α-hydrogen undergo Cannizzaro reaction in the presence of concentrated alkali. The carbonyl group of aldehydes and ketones can be reduced to methylene group by Clemmensen or Wolf Kishner reduction. Aldehydes are easily oxidised to carboxylic acids by Tollen's reagent and Fehling's solution. Functional derivatives of carboxylic acids undergo nucleophilic acyl substitution with nucleophiles.

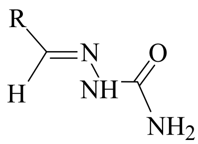
58. In the reaction given hereunder, correct statement (s) about A and B are



(i) A is optically active and dextrorotatory

(ii) A is racemic mixture and optically inactive

(iii) B is 

(iv) B is 

(a) i and iii (b) ii and iv (c) ii and iii (d) i and iv

59. To convert $CH_2{=}CH-CH_2CHO$ to $CH_2{=}CH-CH_2COOH$, the best reagent will be

(a) $KMnO_4$ (b) P.C.C. (c) $[Ag(NH_3)_2]OH$ (d) HIO_4

60. The reactivity order of the following toward nucleophilic substitution will be

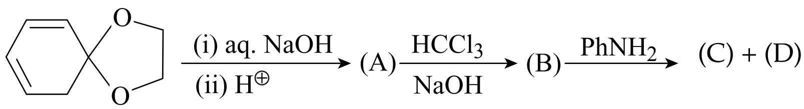
(i) $R-\overset{O}{\overset{\|}{C}}-OR'$ (ii) $R-\overset{O}{\overset{\|}{C}}-Cl$ (iii) $R-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-R$ (iv) $R-\overset{O}{\overset{\|}{C}}-NH_2$

(a) i > iii > iv > ii (b) ii > iii > i > iv

(c) iii > iv > i > ii (d) iii > i > iv > ii

Passage 4

Identify the missing products in the following sequence of reactions.



61. Which statements about compound A are correct?

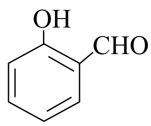
(i) Compound A is used in the formation of phenolphthalein

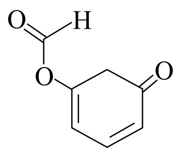
(ii) Compound A is used in the formation of aspirin

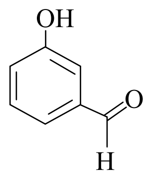
(iii) Compound A gives colour with $FeCl_3$

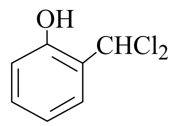
(a) i and iii (b) i and ii (c) ii and iii (d) i, ii and iii

62. Compound B will be

(a) 

(b) 

(c) 

(d) 

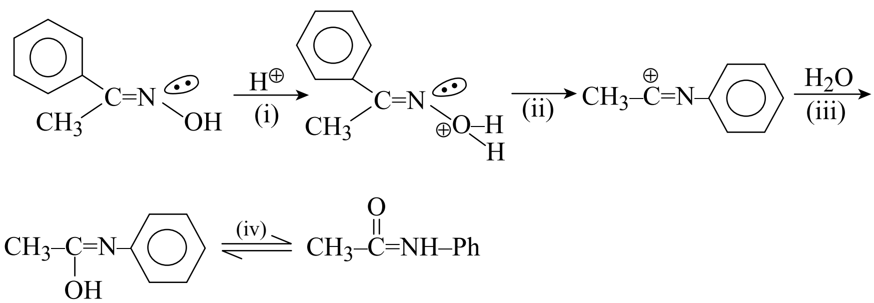
63. Compounds C and D are

(a) Identical (b) Geometrical isomers

(c) Functional isomers (d) Optical isomers

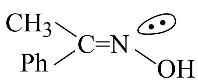
Passage 5

Given hereunder is the mechanism of Beckmann rearrangement.



64. Rate-determing step in Beckmann rearrangement is

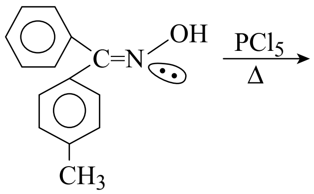
(a) i (b) ii (c) iii (d) iv

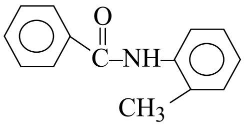
65. 

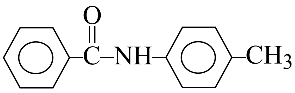
On treatment with H_2SO_4 followed by hydrolysis in acidic medium, the above compound gives

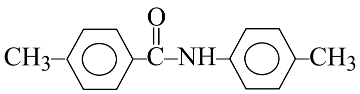
(a) CH_3–CO_2H, Ph–NH_2 (b) Ph–CO_2H + CH_3–CO_2H

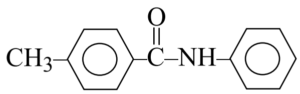
(c) Ph–CH_2–NH_2 + Ph–CO_2H (d) CH_3–NH_2, Ph–CO_2H

66.  (A); Product (A) of the reaction is

(a) 

(b) 

(c) 

(d) 

Passage 6

Ethanal is heated with a base in two separate testtubes. In one testtube nothing except the two mentioned reactants were present. In another testtube, malonic ester, $CH_2(COOR)_2$ was also added. The final products of both testtubes add easily 1, 3-butadiene molecule. The product obtained in the first test tube can be converted into second product identical in all respects with that obtained in the second testtube.

67. The respective reaction involved in the two testtubes are

(a) Aldol condensation and Cannizaro reaction

(b) Aldol condensation and Perkin reaction

(c) Aldol condensation and Knoevenagel reaction

(d) Aldol reaction and Claisen condensation

68. Which feature is common in the products of both reactions?

(a) presence of an acidic group

(b) presence of an aldehydic group

(c) presence of α, β unsaturation

(d) presence of a ketonic group

69. What would have been the final product when ethanal of the first testtube is replaced by propanal?

(a) $CH_3CH_2CH{=}CHCH_2CHO$

(b) $CH_3CH_2CH{=}C(CH_3)CHO$

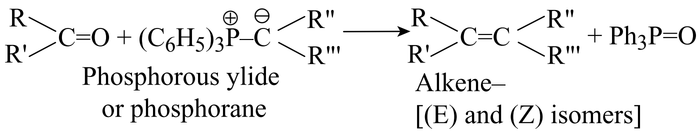
(c) $CH_3CH_2C(CH_3){=}CH{-}CHO$

(d) $CH_3CH{=}CH{-}CH(CH_3)CHO$

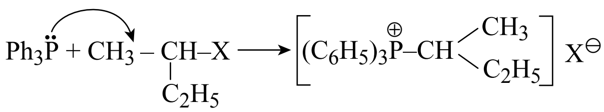
Passage 7

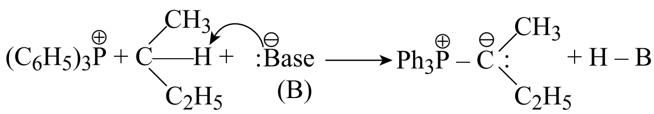
Aldehydes and ketones react with phosphorous ylides to yield alkenes and triphenylphosphine oxide. (An ylide is a neutral molecule having a negative carbon adjacent to appositive heteroatom).

Phosphorous ylides are also called phosphoranes.



Through reaction, known as the Witting reaction, phosphorus ylides are easily prepared from triphenylphosphine and alkyl halides. Their preparation involves two reactions:

Reaction 1: 

Reaction 2: 

Specific example:

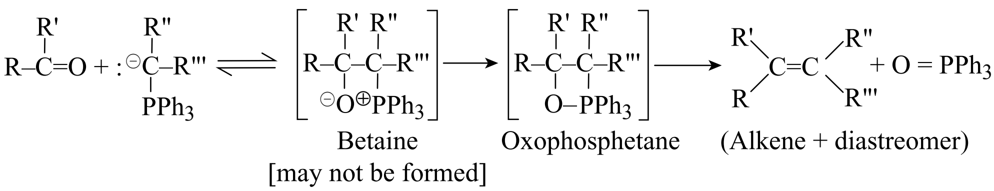
$$Ph_3P + CH_3Br \xrightarrow{C_6H_6} [Ph_3P\text{–}CH_3]\,\overset{\ominus}{Br}$$

[Methyl triphenyl phosphorium bromide]

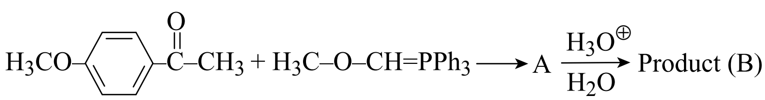
$$[Ph_3\overset{\oplus}{P}\text{–}CH_3]\overset{\ominus}{Br} + C_6H_5Li \longrightarrow Ph_3\overset{\oplus}{P}\text{–}\overset{\ominus}{\ddot{C}}H_2C_6H_6 + Li\,Br$$

ylide

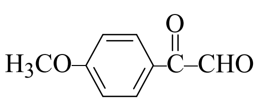
Mechanism of Witting reaction

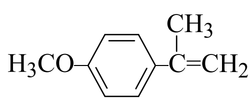


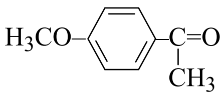
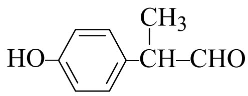
The mechanism suggested that the ylide, acting as a carbonion, attacks the carbonyl carbons of the aldehydes or ketone to form an unstable intermediate with separated change called a betaine. In the next step, betaine forms oxaphosphetane, which spontaneously loses triphenylphosphine oxide to become an alkene.

70. 

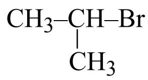
In the given sequence of reaction, the product (B) is

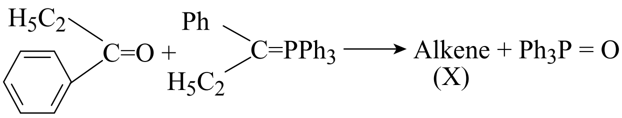
(a) 

(b) 

(c)  (d) 

71. Which of the following cannot be used in the preparation of ylide?

(a) CH_3CH_2Br (b) $(CH_3)_3C–I$ (c)  (d) Both (b) and (c)

72. 

In the given reaction, the correct statement for alkene (X) is

(a) X on reaction with Br_2/CCl_4 forms an optically inactive mixture

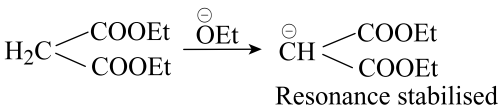
(b) X on reaction with alk. $KMnO_4$ forms an optically inactive mixture

(c) X on reaction with alk. $KMnO_4$ forms an optically active mixture

(d) Both (a) and (b)

Passage 8

Active methylene compounds are of great importance in synthetic chemistry. When $–CH_2$ (methylene) group is flanked between two electron withdrawing groups, then its hydrogen becomes acidic and can be replaced easily. The acidity of methylene hydrogen depends upon the strength of electron withdrawing group. Acetoacetic ester, malonic ester, etc. are the examples of active methylene compound. In synthetic application acidic hydrogen is trapped by a strong base to get resonance stabilised anion which reacts accordingly to give the desired product.



73. $CH_3COCH_2COOEt \xrightarrow[\text{(ii) } CH_3CH_2Br \text{ not in excess}]{\text{(i) NaOEt}} A \xrightarrow[\text{(ii) Heat}]{\text{(i) dil. HCl}}$ Products; Products are

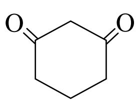
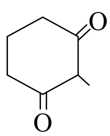
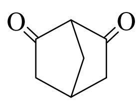
(a) $CH_3COCH_3 + CO_2 + EtOH$

(b) 2 mol of $CH_3COCH_2CH_2CH_3 + CO_2$

(c) $CH_3COCH_2CH_2CH_3 + 2EtOH$

(d) $CH_3COCH_2CH_2CH_3 + EtOH + CO_2$

74. Which one of the following is most effective as an active methylene compound?

(a)  (b) CH_3COCH_2COOEt (c)  (d) 

75. $Ph–\overset{O}{\overset{\|}{C}}H + CH_2\begin{cases} \overset{O}{\overset{\|}{C}}–OC_2H_5 \\ \underset{\underset{O}{\|}}{C}–OC_2H_5 \end{cases} \xrightarrow[\Delta]{\text{Base}} A \xrightarrow[\text{(ii) } \Delta]{\text{(i) } H_3O^{\oplus}} \text{Product}$

The final product is

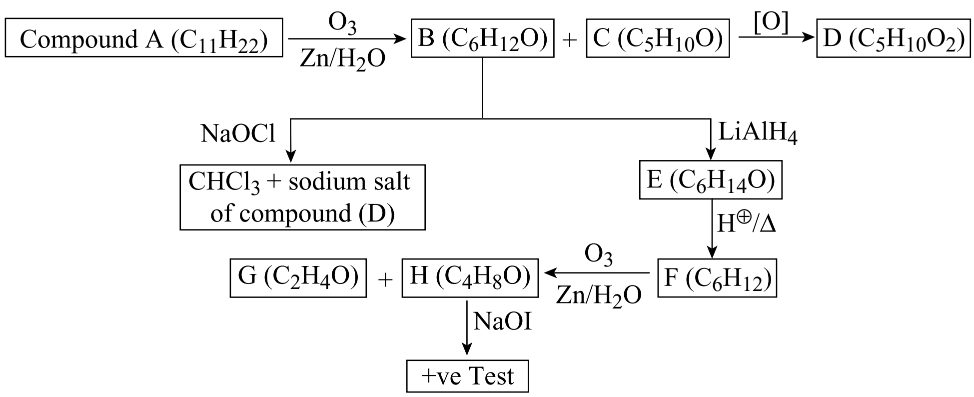
(a) Ph–COOH

(b) $Ph–Ph–\overset{O}{\overset{\|}{C}}–CH=CH–COOH$

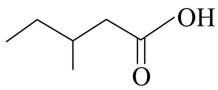
(c) Ph–CH=CH–COOH

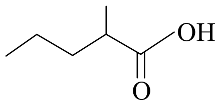
(d) Ph–CH=CH–CHO

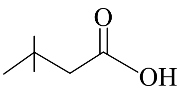
Passage 9

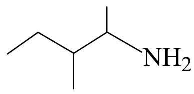


76. $D(C_5H_{12}O_2) \xrightarrow{SOCl_2} x \xrightarrow[H_2O/Ag_2O]{CH_2=\overset{\oplus}{N}=\overset{\ominus}{N}} y$; product y is

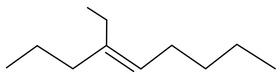
(a) 

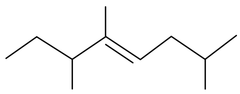
(b) 

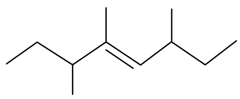
(c) 

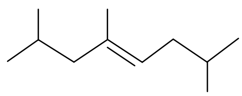
(d) 

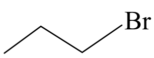
77. Compound A is

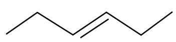
(a) 

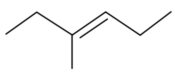
(b) 

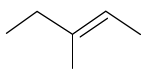
(c) 

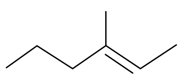
(d) 

78.  $\xrightarrow[Bu^{+}O^{-}K^{+}]{PH_3P} W + H(C_4H_8O) \longrightarrow T$; Product T is

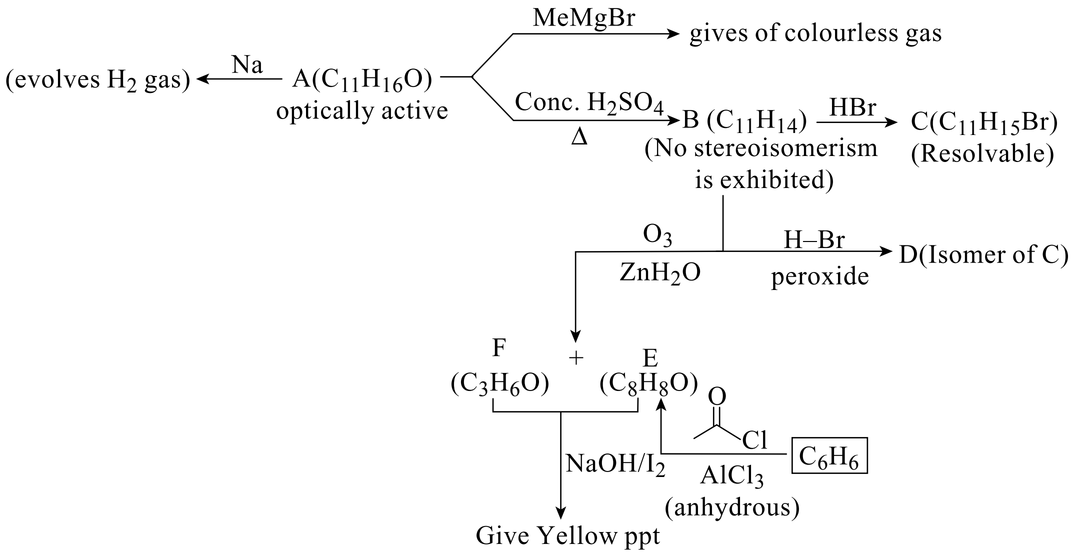
(a) 

(b) 

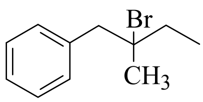
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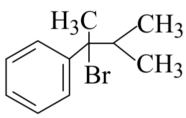
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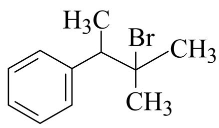
Passage 10

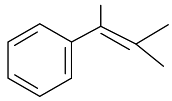


79. Compound (C) is

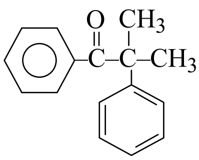
(a) 

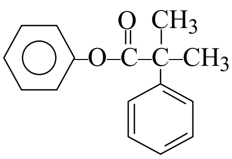
(b) 

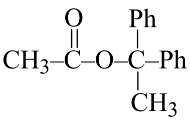
(c) 

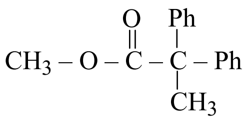
(d) 

80. Compound (E) $\xrightarrow[H_2O]{Mg\text{–}Hg}$ (X) $\xrightarrow[\text{(ii) } F_3C\text{–}C(=O)\text{–}OOH]{\text{(i) } H^{\oplus}}$ (Y); compound (Y) is

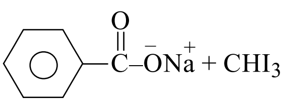
(a) 

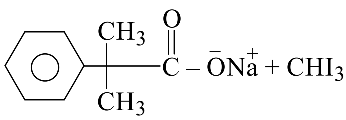
(b) 

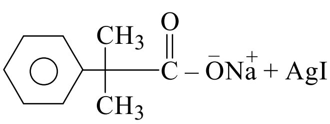
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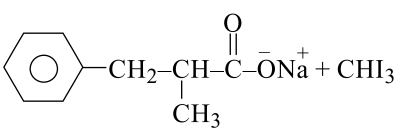
(d) 

81. Compound (A) $\xrightarrow[\text{Acetone (aq.)}]{H_2CrO_4}$ (R) $\xrightarrow{NaOI}$ (S) + (T) (Yellow ppt.). Compound (S) and (T) respectively are

(a) 

(b) 

(c) 

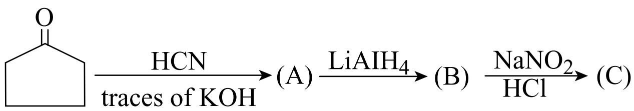
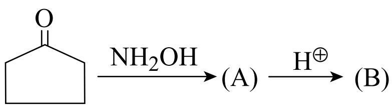
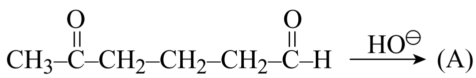
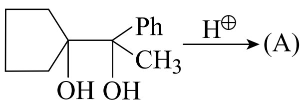
(d) 

Matrix Type

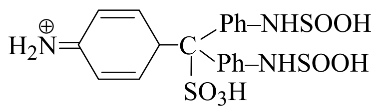
82. Match the reactions in column I with their reagents in column II.

Column I	Column II
(a) $CH_3–CH_2=CH–CHO \rightarrow CH_3CH=CHCOOH$	(p) $LiAlH_4$
(b) $CH_3–CH=CH–CHO \rightarrow CH_3CH=CH–CH_2OH$	(q) $NaBH_4$
(c) $Ph–CH=CH–CHO \rightarrow Ph–CH_2–CH_2–CHO$	(r) $Pd–C/H_2$
(d) $CH_2=CH–CH_2CHO \rightarrow CH_2=CH–CH_2CH_2OH$	(s) $Ag(NH_3)_2^{\oplus}$

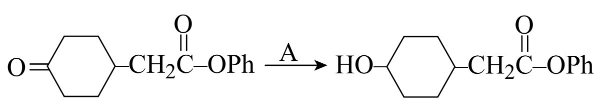
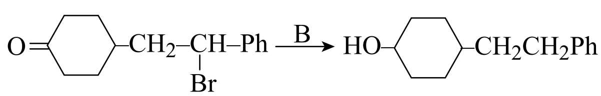
83. Match the columns.

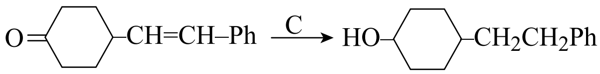
Column I	Column II (In the given sequence)
(a) 	(p) Formation of six member ring takes place
(b) 	(q) Final product is ketone
(c) 	(r) Final product formed will give positive Tollen's test
(d) 	(s) Final product formed will react with 2,4-DNP. (2, 4-di-nitrophenyl hydrazine)

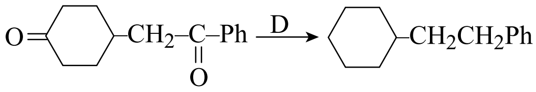
84. Match the chemical compounds in Column I with the reagents used to test them in Column II.

Column I	Column II
(a) Ethanol	(p) $[Ag(NH_3)_2]OH$
(b) Glucose	(q) Fehling's solution
(c) Glyoxal	(r) 
(d) Acetone	(s) $I_2/NaOH$

85. Match the columns.

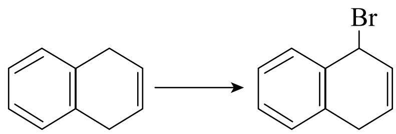
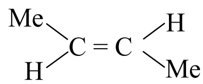
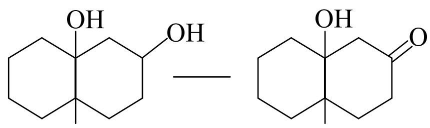
Column I (Reaction)	Column II (Reducing reagent)
(a) 	(p) Zn + Hg/HCl
(b) 	(q) $LiAlH_4$

(c)  (r) $NaBH_4$

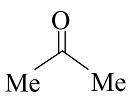
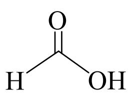
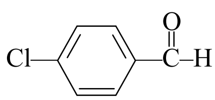
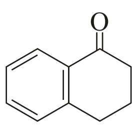
(d)  (s) Red P + HI

(t) Ni/H_2

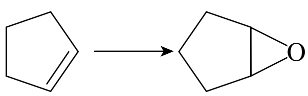
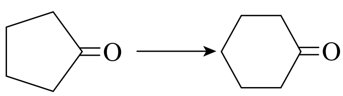
86. Match the columns.

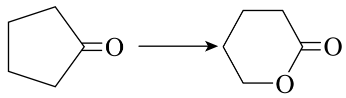
Column I	Column II
(a) PCC (Pyridiniumchlorochromate)	(p) 
(b) NBS (N-Bromosuccinimide)	(q) $MeC \equiv CMe \longrightarrow$ 
(c) $AlPO_4$	(r) 
(d) Li/Liquid NH_3	(s) $CH_3COOH \longrightarrow CH_2 = C = O$

87. Match column I with column II.

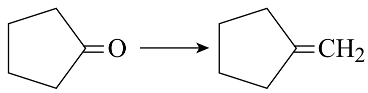
Column I	Column II
(a) 	(p) 2, 4-DNP test
(b) 	(q) Tollen's reagent test
(c) 	(r) I_2 + NaOH (Iodoform test)
(d) 	(s) Fehling's solution test

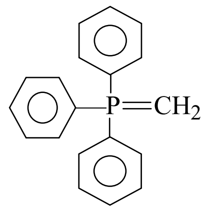
88. Match column I with column II.

Column I (conversion)	Column II (reagents)
(a) 	(p) HCN; H_2/Ni; HNO_2
(b) 	(q) CH_2N_2

(c) 

(r) m-CPBA (Meta-chloroperbenzoic acid)

(d) 

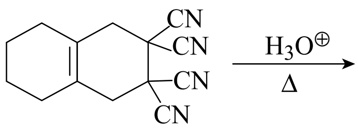
(s) 

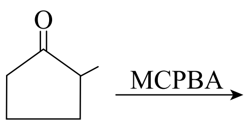
89. Match Column I with Column II.

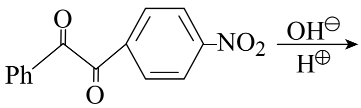
Column I	Column II
(a) Aldol condensation	(p) Hydride ion transfer
(b) Cannizzaro reaction	(q) Zinc enolate
(c) Reformatsky reaction	(r) $\overline{C}N$ as catalyst
(d) Benzoin condensation	(s) Enolate ion

90. Match the coloumns.

Column I

(a)  Product

(b)  Product

(c)  Product

Column II

(p) Anhydride

(q) Carboxylic acid

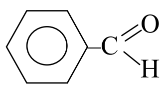
(r) Alkene

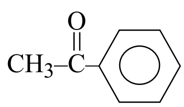
(s) Optical active compound

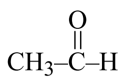
(t) Ester

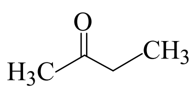
91. Match the columns.

Column I (compound)

(a) 

(b) 

(c) 

(d) 

Column II (Tests)

(p) 2, 4-DNP test

(q) Yellow ppt. with NaOH + I_2

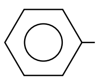
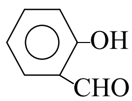
(r) Red ppt. with Fehling's solution

(s) Silver mirror with Tollen's reagent

92. Match the columns.

Column I (Reagents)	**Column II**
(a) Tollen's reagent give white ppt. with	(p) Me–CH=CH–Me
(b) $Br_2 + H_2O$ test given by	(q) Me–C≡C–H
(c) Product of reaction of acetylene with 1% $HgSO_4$ and dil. H_2SO_4	(r) $Cl\overset{\oplus}{N}H_3 - NH_2$
(d) Pd/H_2 reacts with	(s) $Me-\overset{O}{\overset{\Vert}{C}}-H$
	(r) $Me-\overset{O}{\overset{\Vert}{C}}-Me$

93. Match column I with column II.

Column I	**Column II**
(a) $CH_3CHO + CH_3CH_2CHO \xrightarrow[\Delta]{\text{dil. } \overset{\ominus}{O}H}$	(p) $CH_3-CH_2CH=CH-CHO$
(b) $PhCHO + CH_3-\underset{\underset{O}{\Vert}}{C}-CH_3 \xrightarrow[\Delta]{\overset{\ominus}{O}H}$	(q) $CH_3-\underset{\underset{CHO}{\vert}}{C}=CH-CH_3$
(c) $PhCHO + HCHO \xrightarrow[\Delta]{\overset{\ominus}{O}H}$	(r) $HCOO^-$
(d)  $-OH + CHCl_3 \xrightarrow[\Delta]{\overset{\ominus}{O}H}$	(s) $Ph-CH=CH-\overset{O}{\overset{\Vert}{C}}-Me$
	(t) 

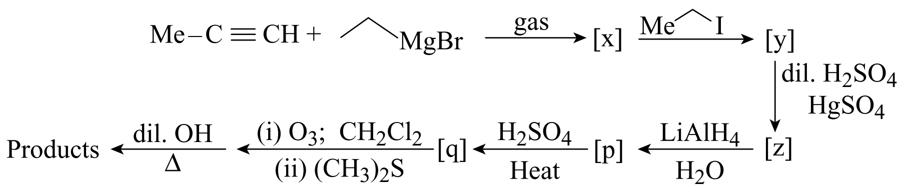
94. Match the column I with column II.

Column I	**Column II**
(a) Schimdt reaction	(p) $RCOOH \xrightarrow[\Delta]{NaOH/CaO} RH$
(b) Curtius reaction	(q) $R-CH_2COOH \xrightarrow[\Delta]{\text{Red } P/X_2} R-\underset{\underset{X}{\vert}}{C}H-COOH$
(c) Decarboxylation	(r) $RCOCl \xrightarrow[\Delta \text{ (ii) } H_3O]{\text{(i) } NaN_3} RNH_2$
(d) HVZ reaction	(s) $RCOOH \xrightarrow[\Delta]{N_3H} RNH_2$

Integer Type

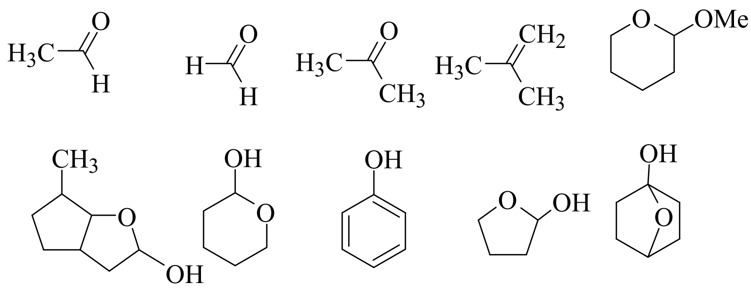
95. How many products are possible when ethanal and phenyl ethanal (mixture) is treated with dil. NaOH at about 10°C.

96. For the given sequence of reaction

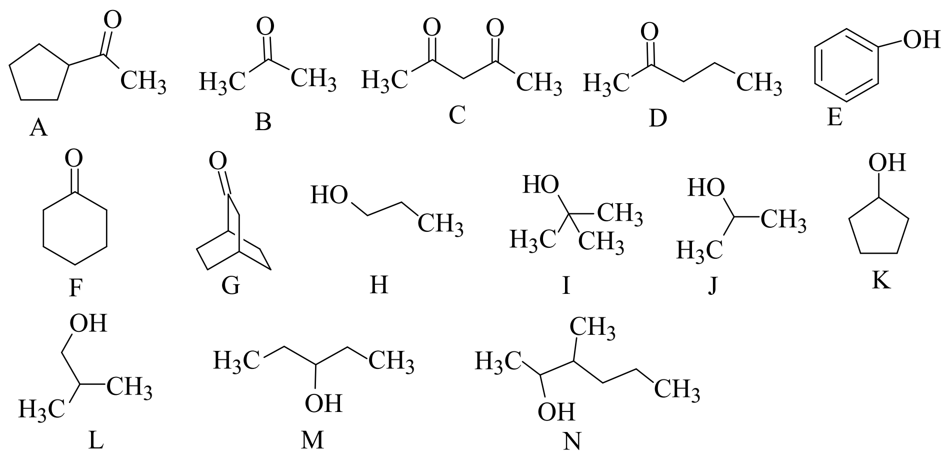


How many products are obtained finally?

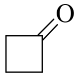
97. Identify the total number of compounds that give positive test with Tollen's reagent

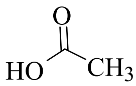


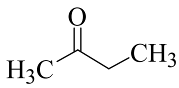
98. Identify the total number of compounds that give positive iodoform test

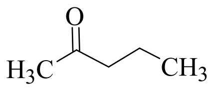


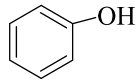
99. Identify the total number of compounds that give diastereomeric product on reaction with MeMgCl

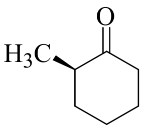

A

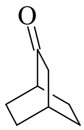

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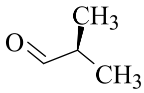

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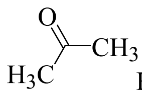

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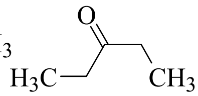

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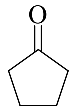

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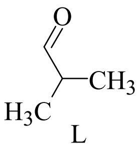

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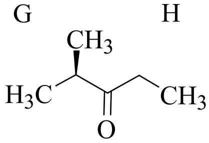

H

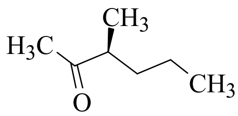

I


J

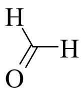

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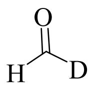

L

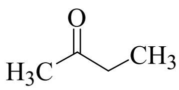

M

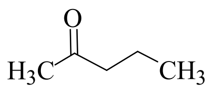

N

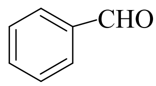
100. Identify that compounds that give Cannizaro reaction

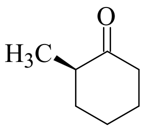

A

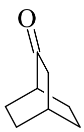

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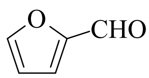

C


D


E

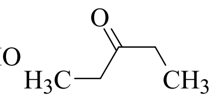

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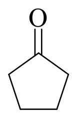

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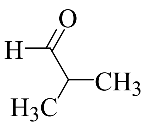

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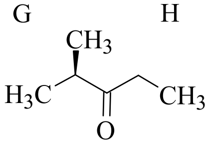
OHC−CHO

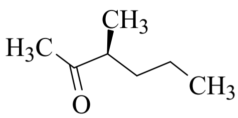
I


J


K


L


M


N

Answer Keys

LEVEL 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
c	d	d	b	d	c	a	d	c	bd	b	a	a	c	c
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
ab	d	d	c	a	b	d	a	bc	b	d	c	b	a	b
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
ab	abcd	d	d	c	a	d	c	b	c	a	b	c	abd	b
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
b	a	b	c	d	d	c	b	b	c	a	a	d	c	bc
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
b	b	c	a	c	b	d	b	c	b	a	d	c	b	d
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
b	a	b	b	a	c	b	c	b	b	a	c	a	d	b
91	92	93	94	95	96	97	98	99	100	101	102	103	104	
d	d	a	b	a	a	d	d	b	a	d	c	d	d	

LEVEL 2

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
c	ac	bc	ab	abc	d	ab	bd	bd	bcd	b	bcd	a	b	abc
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
abd	bcd	ac	abc	abc	bd	ab	ab	bc	ab	bd	a	c	d	b
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
a	a	b	b	b	d	a	c	b	a	a	b	c	a	b
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
a	b	d	b	a	a	c	b	b	b	a	a	b	c	b
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
d	a	b	b	d	b	c	c	b	d	b	d	d	a	c
76	77	78	79	80	81	82(a)	82(b)	82(c)	82(d)	83(a)	83(b)	83(c)	83(d)	84(a)
a	c	b	b	c	b	s	p	r	pq	pqs	p	pqs	pqs	s
84(b)	84(c)	84(d)	85(a)	85(b)	85(c)	85(d)	86(a)	86(b)	86(c)	86(d)	87(a)	87(b)	87(c)	87(d)
pq	pqr	s	r	qr	t	ps	r	pr	s	q	pr	qs	pq	p
88(a)	88(b)	88(c)	88(d)	89(a)	89(b)	89(c)	89(d)	90(a)	90(b)	90(c)	91(a)	91(b)	91(c)	91(d)
r	pq	r	s	s	p	q	r	pr	st	qs	ps	pq	pqrs	pq
92(a)	92(b)	92(c)	92(d)	93(a)	93(b)	93(c)	93(d)	94(a)	94(b)	94(c)	94(d)	95	96	97
qr	pq	s	pqst	pq	s	r	t	s	r	p	q	12	11	6
98	99	100												
6	2	6												

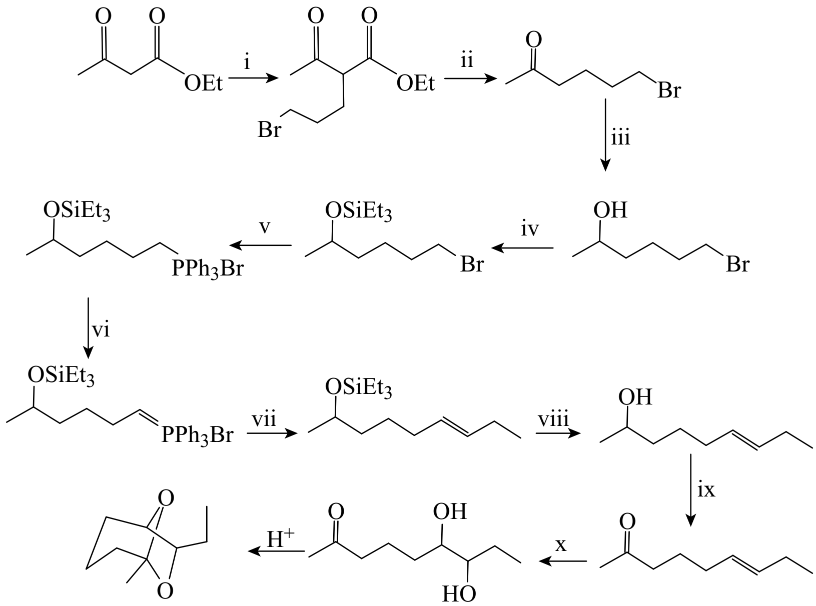
WORKBOOK EXERCISES

EXERCISE 1

Identify reagents (1 to 10) used in the following conversion from reagent present in second Column II (A to P).

Column I (Conversion) **Column II (Reagent)**

Conversion



Reagent

A. $CH_3CH_2CH_2CH_2Li$ / THF

B. $CH_3CH_2CH_2Br$

C. Et_3SiCl / Et_3N

D. Et_3SiH / pyridine

E. CH_3CHO

F. CH_3CH_2CHO

G. PDC

H. PPH_3

I. $CH_2=CHCH_2Br$

J. H_3O^+ / Δ

K. Conc. H_2SO_4 / Δ

L. NaOEt then $Br(CH_2)_3Br$

M. Et_3N

N. $NaBH_4$ then H_3O^+

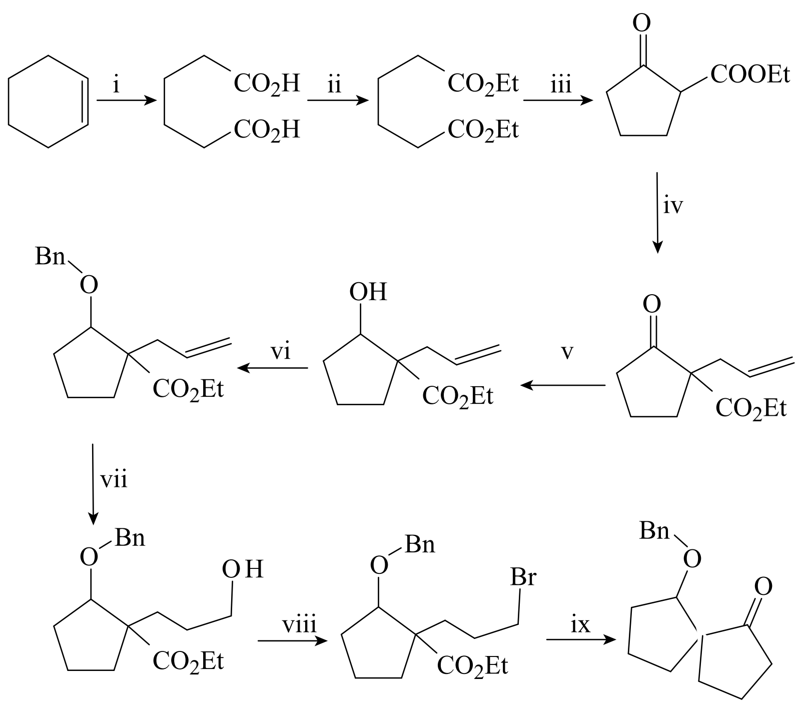
O. Bu_4NF then H_2O

P. $KMnO_4$ / aq. NaOH / 0ºC

EXERCISE 2

Identify reagents (1 to 10) used in the following conversion from reagent present in second Column II (A to T).

Column I (Conversion)



NOTE: Bn = Benzyl group, $PhCH_2^-$

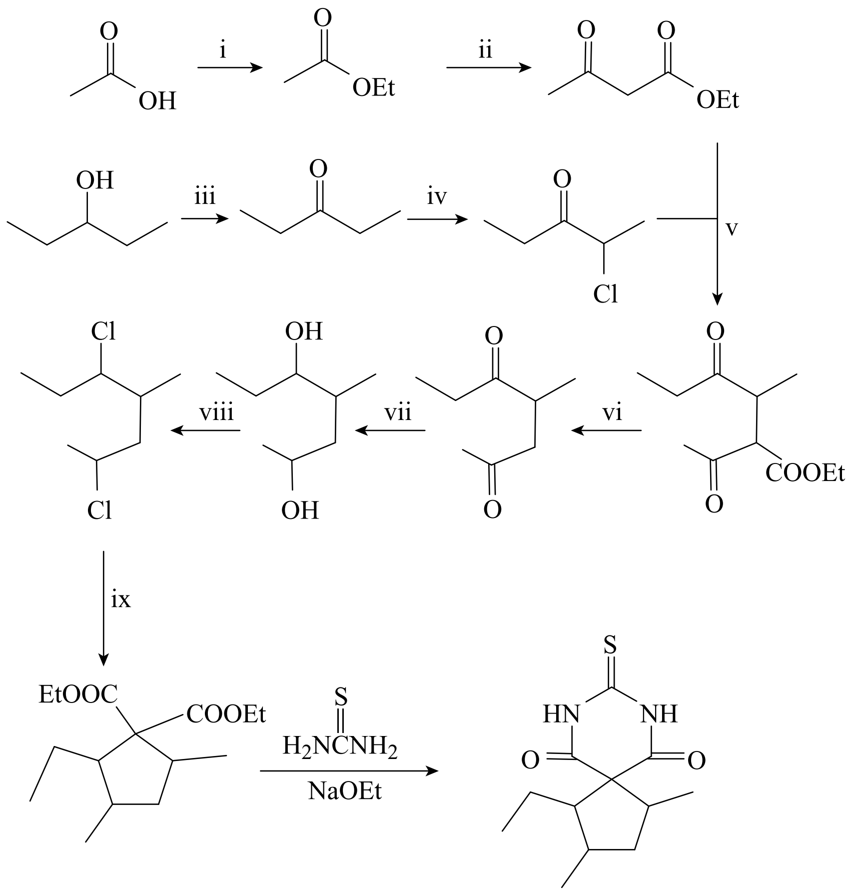
Column II (Reagent)

(A) $NaBH_4$ then NH_4Cl
(B) $LiAlH_4$ then H_3O^+
(C) O_3 then Zn / CH_3CO_2H
(D) O_3 then H_2O_2
(E) NaOH
(F) Na dissolved in EtOH
(G) AC. H_3O^+
(H) BH_3 then NaOH / H_2O_2
(I) Na then add PhBr
(J) Na then add $PhCH_2Br$
(K) Pyridinium chlorochromate
(L) $Na_2Cr_2O_7$ / H_3O^+
(M) NaBr / acetone
(N) PBr_3
(O) Br_2 / hv
(P) LDA / THF / –78ºC
(Q) Mg / Et_2O
(R) EtOH / H^+ / heat
(S) CH_2=CH–CH_2MgBr
(T) NaOEt then CH_2=CH–CH_2Br

EXERCISE 3

Identify reagents (1 to 10) used in the following conversion from reagent present in second Column II (A to P).

Column I (Conversion)



Spirothiobarbital

Column II (Reagent)

(A) NaH

(B) Na / THF then MeOH

(C) H_2 / Pd

(D) NaOH /Cl_2

(E) HCl / Cl_2

(F) PCl_3

(G) 1 mol. eq. $LiAlH_4$ then H_3O^+

(H) Pyridinium chlorochromate

(I) H_2O_2

(J) H_3O^+ / Δ

(K) Conc. H_2SO_4 / Δ

(L) EtOH / H^+ / Δ

(M) NaOEt / EtOH

(N) $LiNiPr_2$ / THF

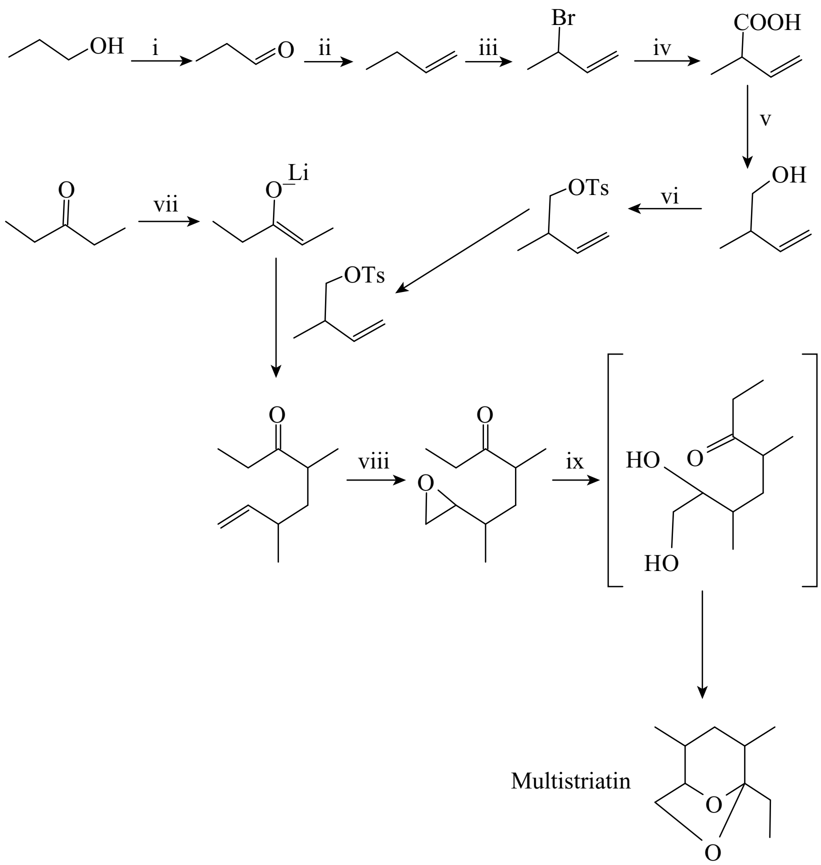
(O) Aq. NaOH / Δ

(P) NaOEt / EtOH / $CH_2(CO_2Et)_2$

EXERCISE 4

Identify reagents (1 to 10) used in the following conversion from reagent present in second Column II (A to O).

Column I (Conversion)



Column II (Reagent)

(A) 1 eq $NaBH_4$ then H_3O^+

(B) 1 eq $LiAlH_4$ then H_3O^+

(C) Ph_3PCH_2

(D) NaTs / DMSO

(E) MCPBA

(F) Br_2 /hν

(G) PBr_3

(H) Pyridinium chlorochromate

(I) Mg then CO_2 then H_3O^+

(J) Conc. H_2SO_4 /Δ

(K) TsCl / pyridine

(L) NaOEt / EtOH

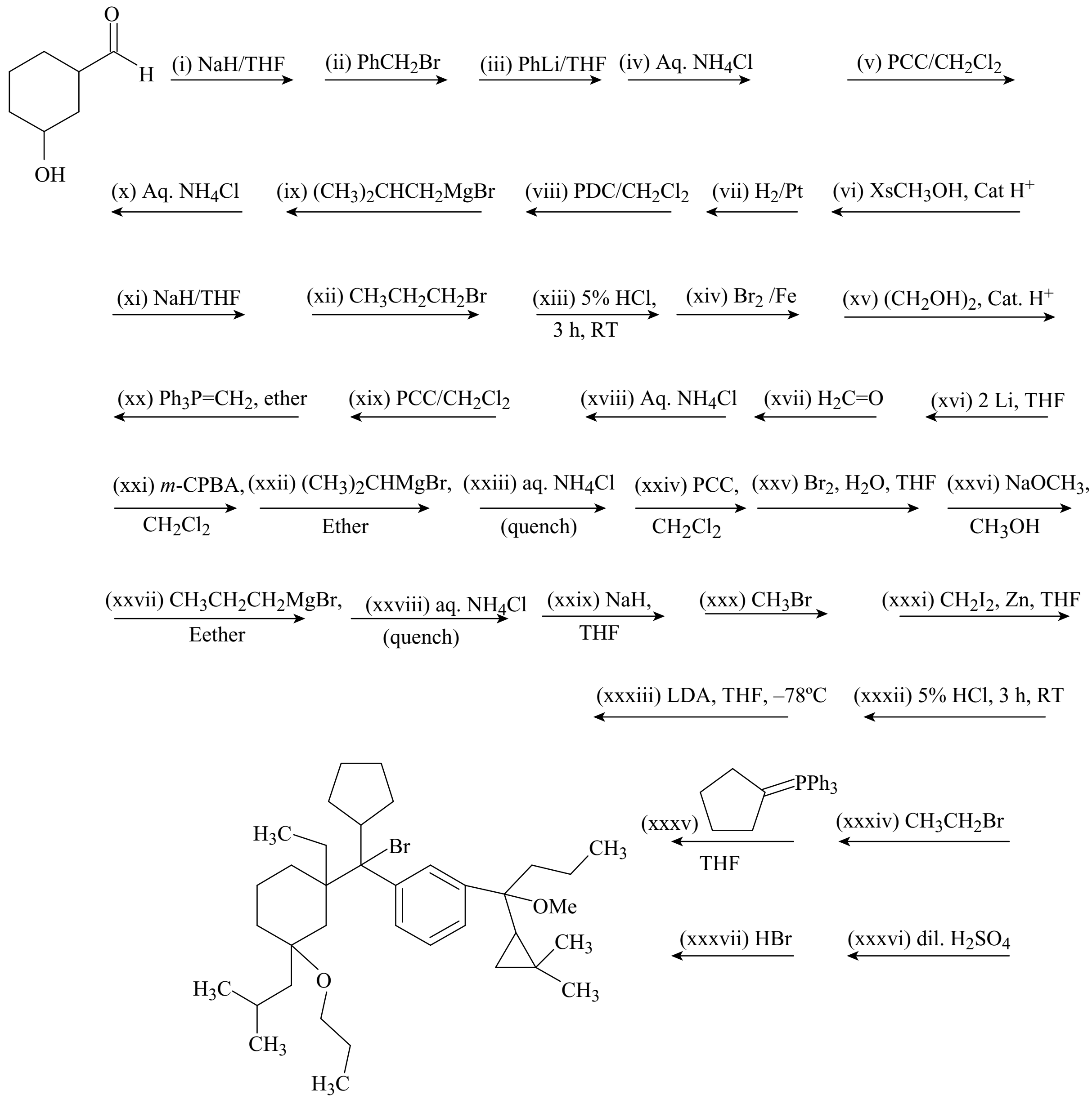
(M) $LiNiPr_2$ / THF

(N) LiCl / DMF

(O) NaOH then CrO_3 / pyridine

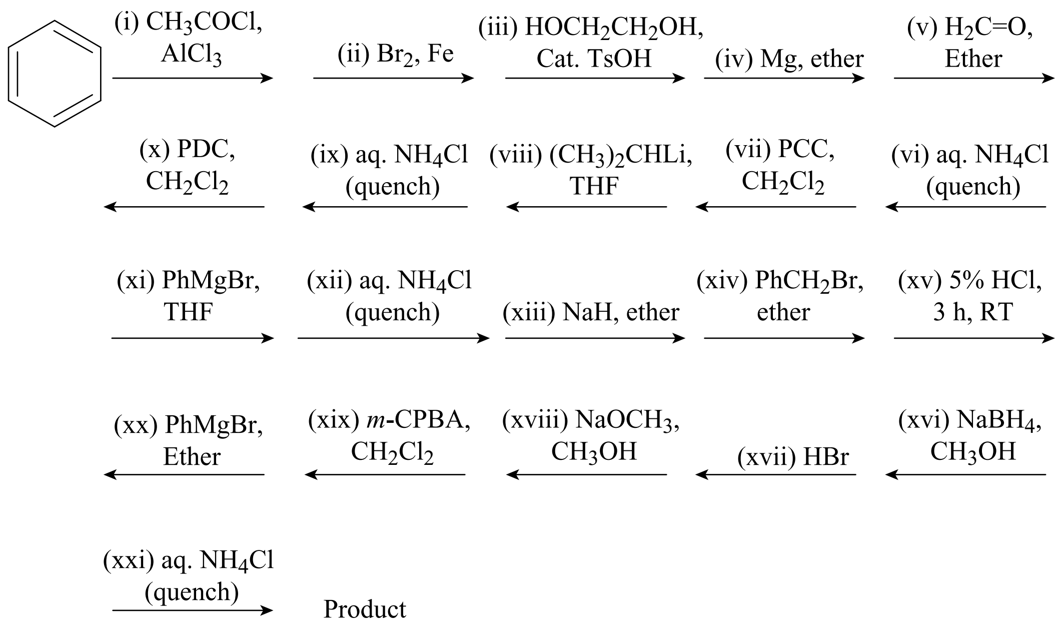
EXERCISE 5

Identify the intermediate product in the following conversion



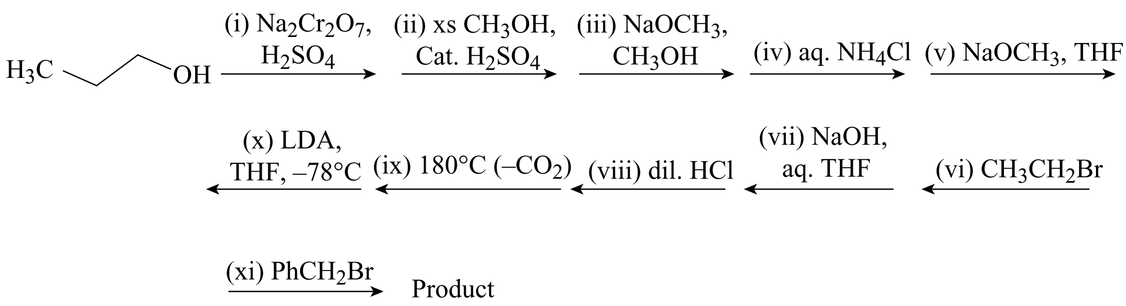
EXERCISE 6

Identify the intermediate product in the following conversion



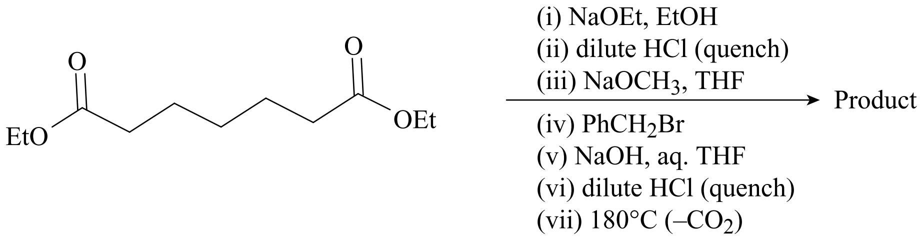
EXERCISE 7

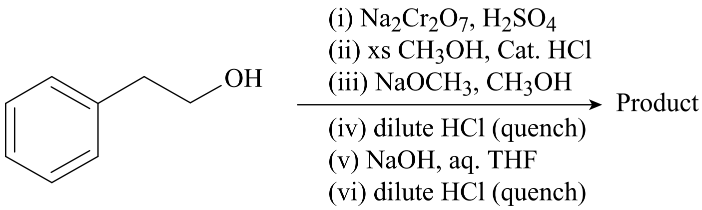
Identify the intermediate product in the following conversion

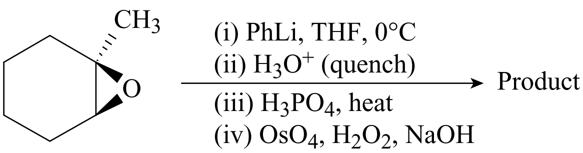


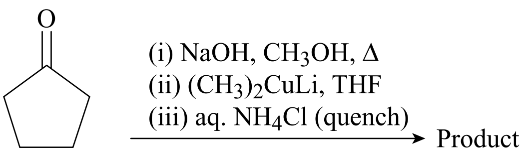
EXERCISE 8

Identify the final product in the following reaction sequence

(a) 

(b) 

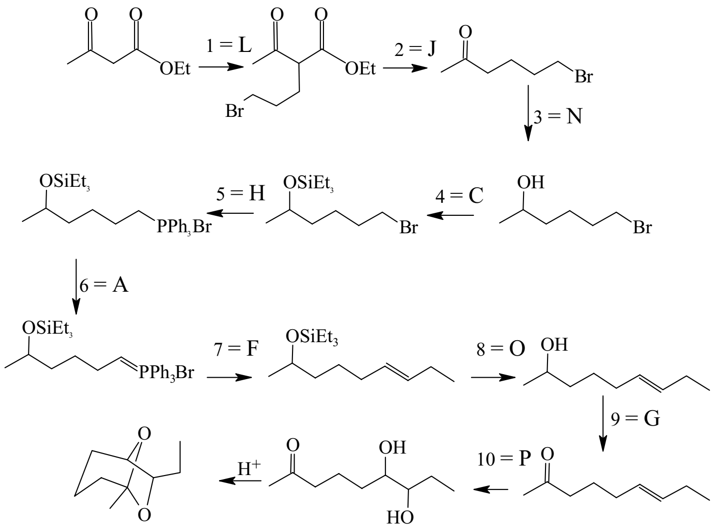
(c) 

(d) 

SOLUTION FOR WORKBOOK EXERCISES

EXERCISE 1

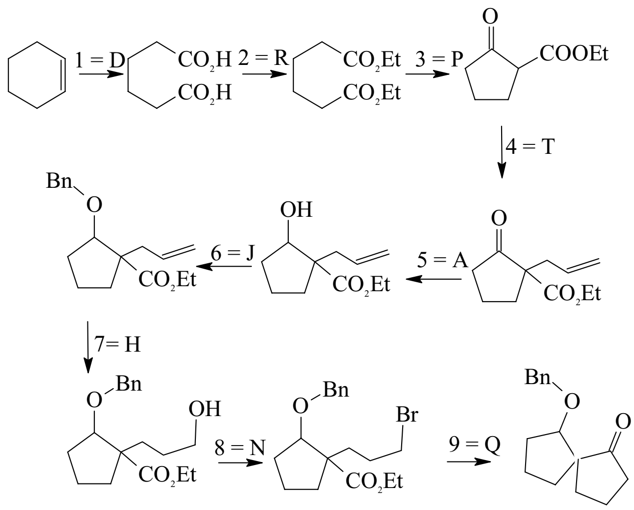
Conversion



Reagent

(A) $CH_3CH_2CH_2CH_2Li$ / THF
(B) $CH_3CH_2CH_2Br$
(C) Et_3SiCl / Et_3N
(D) Et_3SiH / pyridine
(E) CH_3CHO
(F) CH_3CH_2CHO
(G) PDC
(H) PPh_3
(I) $CH_2{=}CHCH_2Br$
(J) H_3O+ / Δ
(K) Conc. H_2SO_4 / Δ
(L) NaOEt then $Br(CH_2)_3Br$
(M) Et_3N
(N) $NaBH_4$ then H_3O_+
(O) Bu_4NF then H_2O
(P) $KMnO_4$ / aq NaOH / 0ºC

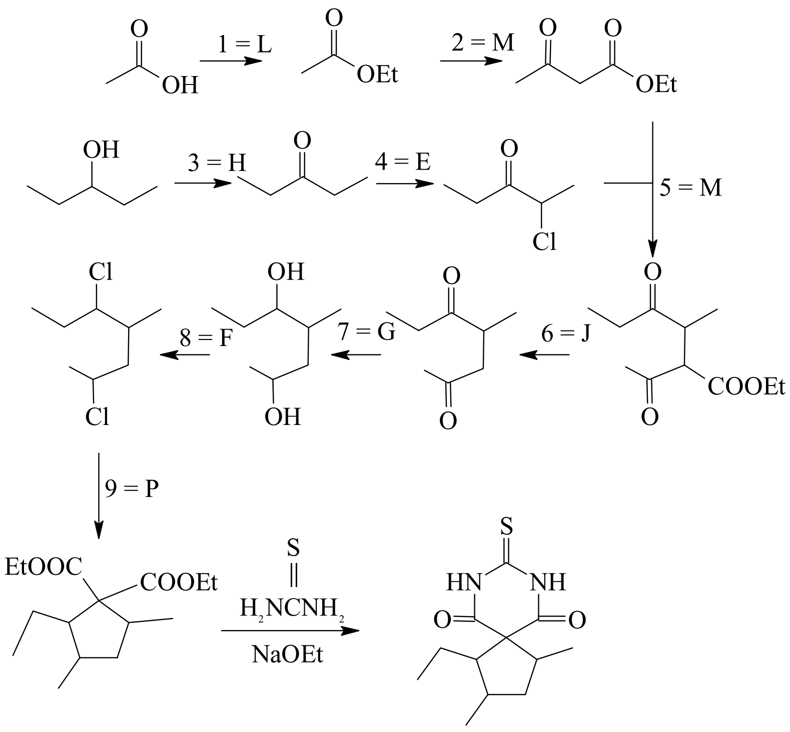
EXERCISE 2



NOTE: Bn = Benzyl group, $PhCH_2^-$

(A) $NaBH_4$ then H_3O^+
(B) $LiAlH_4$ then H_3O^+
(C) O_3 then Zn / CH_3CO_2H
(D) O_3 then H_2O_2
(E) NaOH
(F) Na dissolved in EtOH
(G) AC. H_3O^+
(H) BH_3 then NaOH / H_2O_2
(I) Na then add PhBr
(J) Na then add $PhCH_2Br$
(K) Pyridinium chlorochromate
(L) $Na_2Cr_2O_7$ / H_3O^+
(M) NaBr / acetone
(N) PBr_3
(O) Br_2 / hv
(P) LDA / THF / –78ºC
(Q) Mg / Et_2O
(R) EtOH / H^+ / heat
(S) CH_2=CH–CH_2MgBr
(T) NaOEt then CH_2=CH–CH_2Br

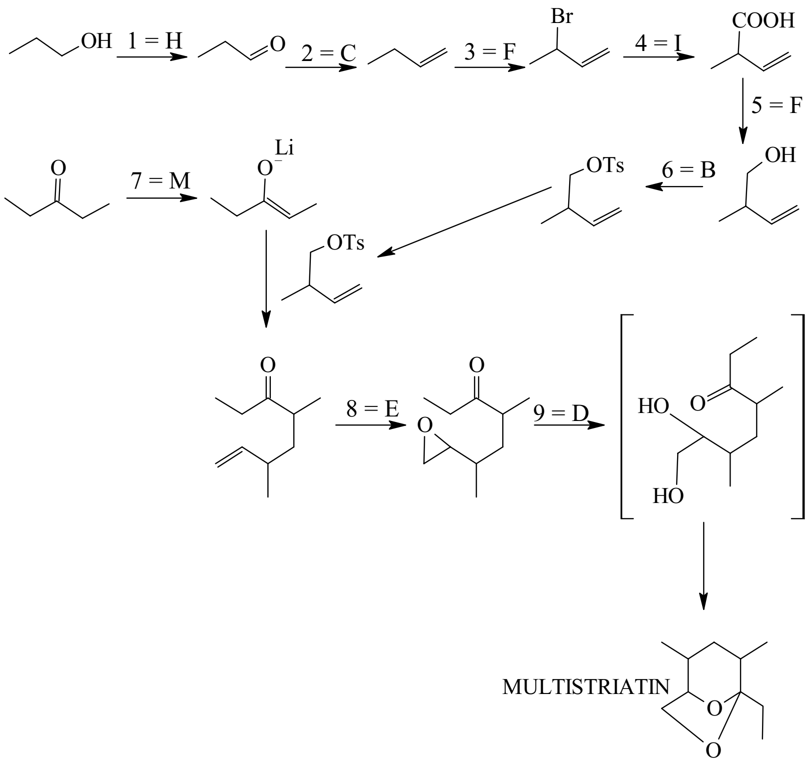
EXERCISE 3



SPIROTHIOBARBITAL

(A) NaH
(B) Na / THF then MeOH
(C) H_2 /Pd
(D) NaOH /Cl_2
(E) HCl / Cl_2
(F) PCl_3
(G) 1 mol. eq. $LiAlH_4$ then H_3O^+
(H) Pyridinium chlorochromate
(I) H_2O_2
(J) H_3O^+ / Δ
(K) Conc. H_2SO_4 / Δ
(L) EtOH / H^+ / Δ
(M) NaOEt / EtOH
(N) Li $NiPr_2$ / THF
(O) Aq. NaOH / Δ
(P) NaOEt / EtOH / $CH_2(CO_2Et)_2$

EXERCISE 4



(A) 1 eq $NaBH_4$ then H_3O^+

(B) 1 eq $LiAlH_4$ then H_3O^+

(C) Ph_3PCH_2

(D) NaOH / DMSO/ H_2O

(E) MCPBA

(F) Br_2 /hν

(G) PBr_3

(H) Pyridinium chlorochromate

(I) Mg then CO_2 then H_3O^+ BC. H_3O^+

(J) Conc. H_2SO_4 / Δ

(K) TsCl / pyridine

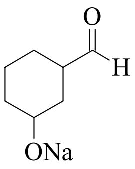
(L) NaOEt / EtOH

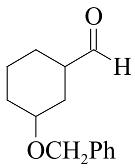
(M) Li NiPr_2 / THF

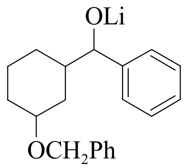
(N) LiCl / DMF

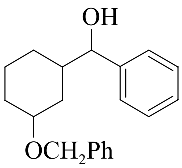
(O) NaOH then CrO_3 / pyridine

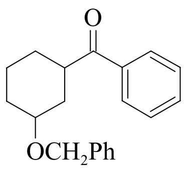
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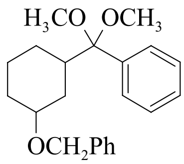
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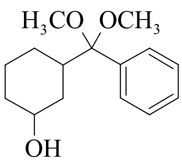
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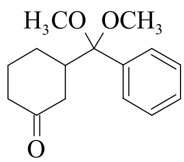
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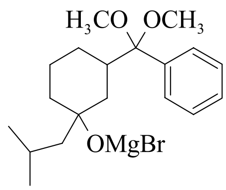
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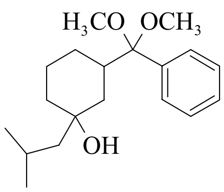
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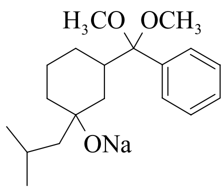
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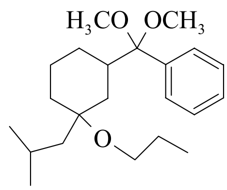
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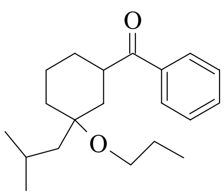
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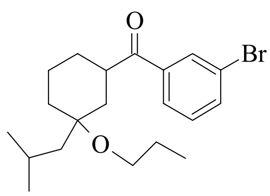
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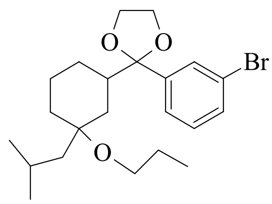
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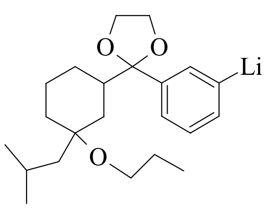
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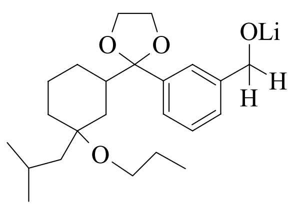
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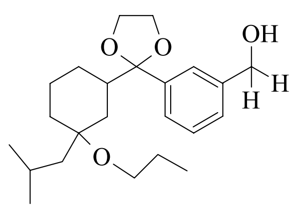
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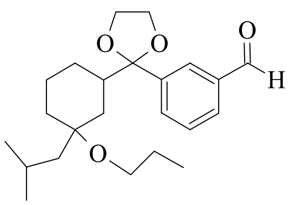
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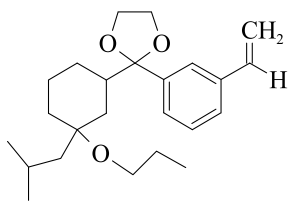
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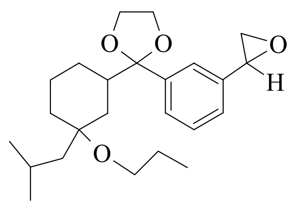
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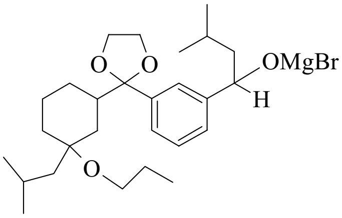
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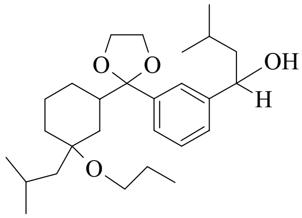
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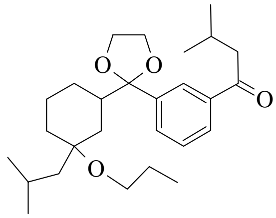
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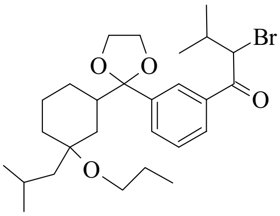
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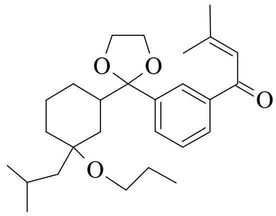
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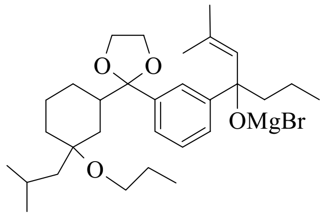
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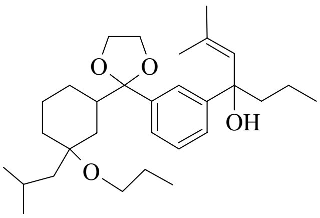
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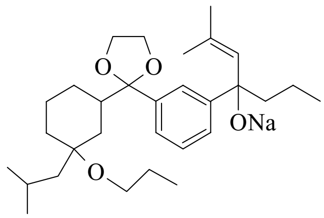
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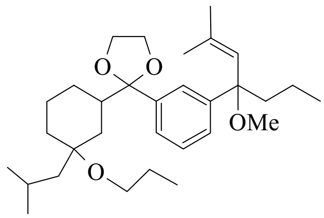
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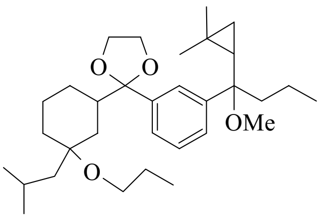
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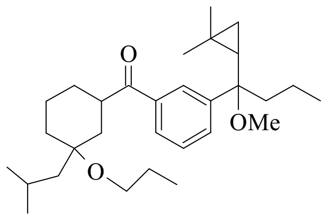
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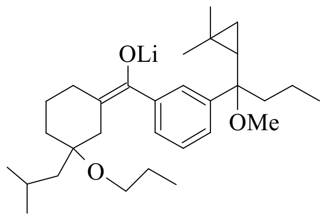
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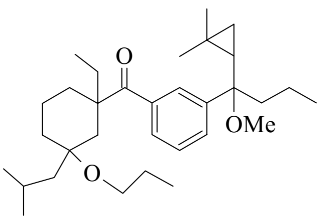
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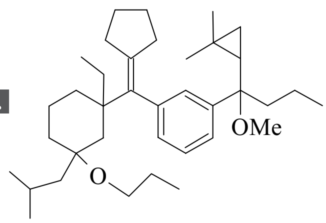
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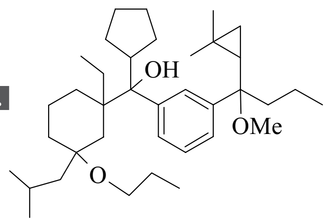
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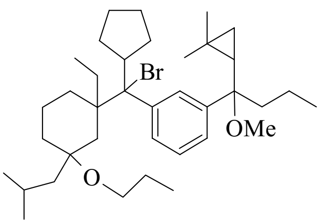
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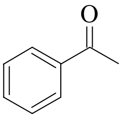
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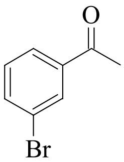


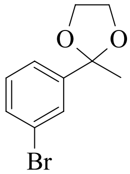
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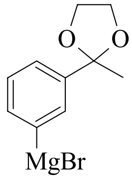


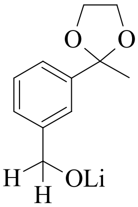
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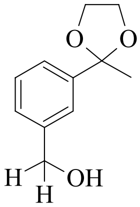
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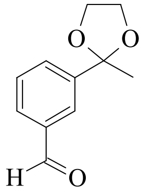
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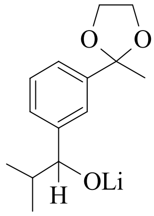
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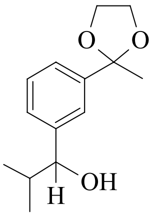
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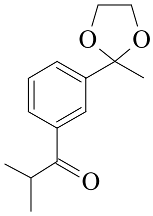
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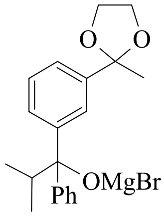
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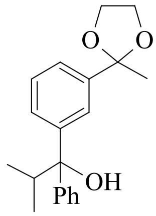
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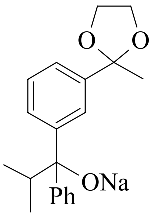
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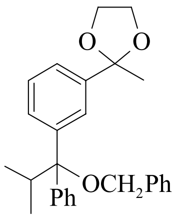
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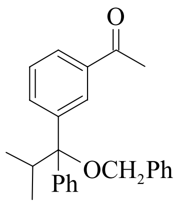
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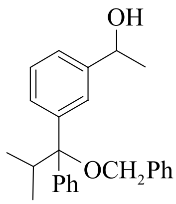
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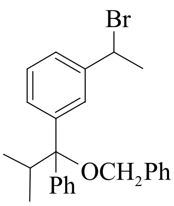
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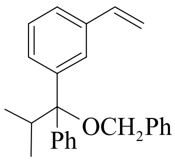
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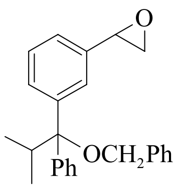
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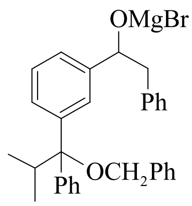
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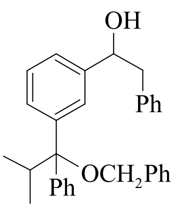
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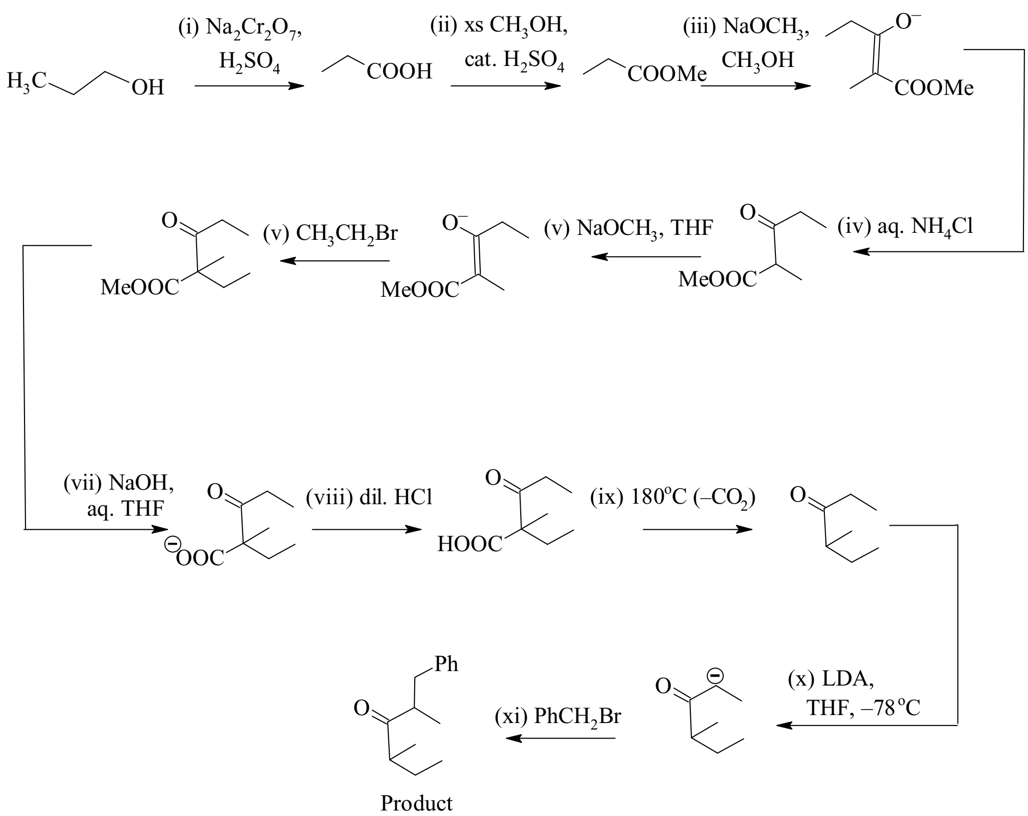
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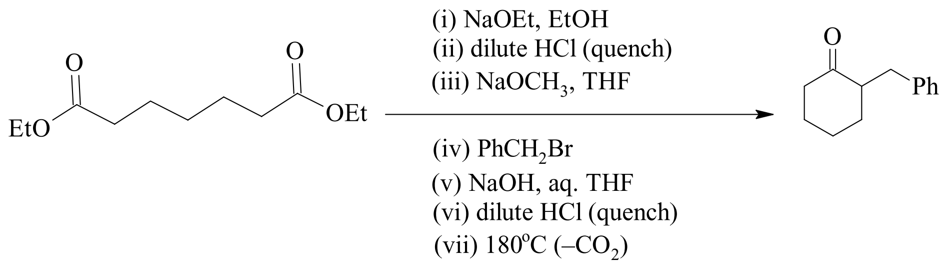
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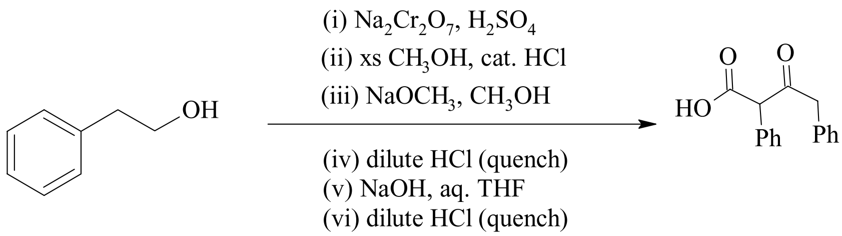
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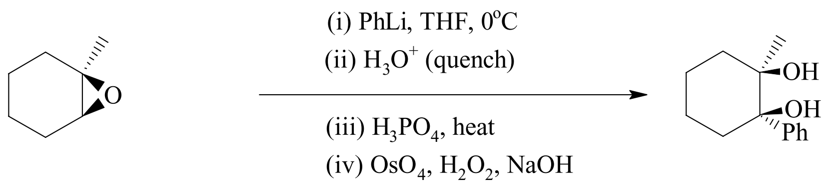
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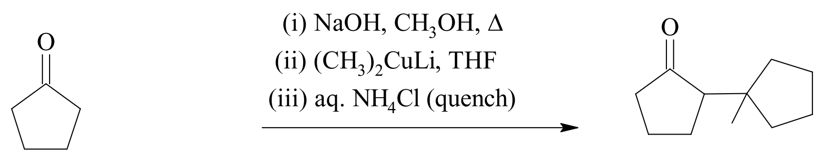

(i) Na$_2$Cr$_2$O$_7$, H$_2$SO$_4$
(ii) xs CH$_3$OH, cat. H$_2$SO$_4$
(iii) NaOCH$_3$, CH$_3$OH
(iv) aq. NH$_4$Cl
(v) NaOCH$_3$, THF
(v) CH$_3$CH$_2$Br
(vii) NaOH, aq. THF
(viii) dil. HCl
(ix) 180°C (–CO$_2$)
(x) LDA, THF, –78°C
(xi) PhCH$_2$Br
Product

EXERCISE 8

(A) 

(B) 

(C) 

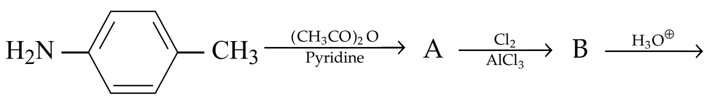
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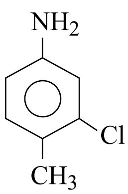
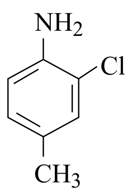
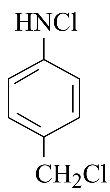
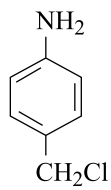
CHAPTER 6

ESR Amines and Phenols

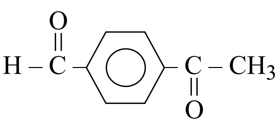
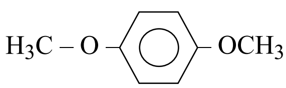
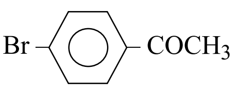
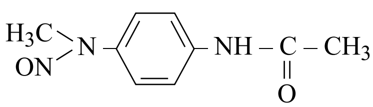
Question Bank

LEVEL 1

1. In the given reaction  the product (C) will be

(a) 
(b) 
(c) 
(d) 

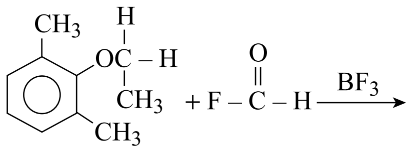
2. Rank the following compounds in order of decreasing reactivity for nitration.

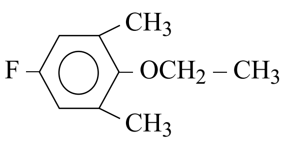
(i) 
(ii) 
(iii) 
(iv) 

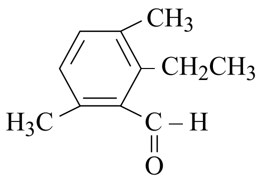
Select the correct answer from the following:

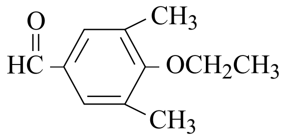
(a) iv > ii > i > iii
(b) ii > iv > iii > i
(c) ii > iv > i > iii
(d) i > ii > iii > iv

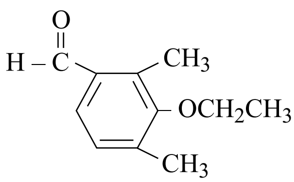
3. In the given reaction major product (P) will be



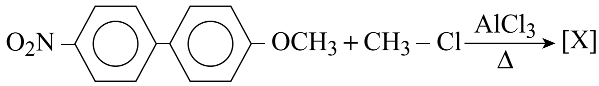
(a) 

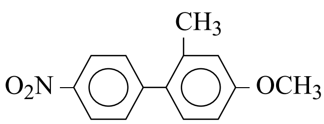
(b) 

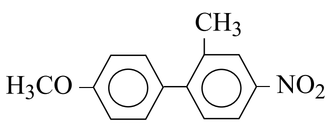
(c) 

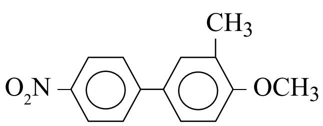
(d) 

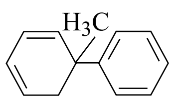
4. The major product [X] of the given reaction is



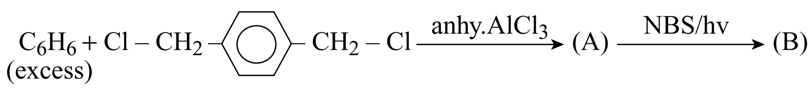
(a) 

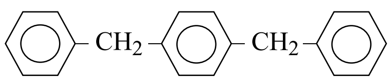
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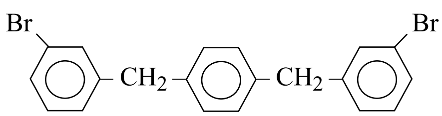
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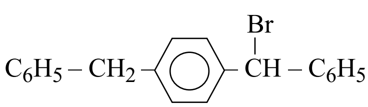
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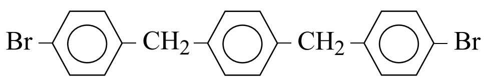
5. In the given reaction sequence, identify (B)



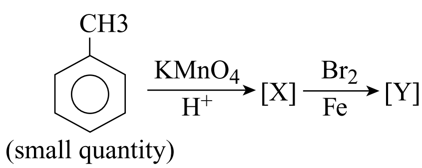
(a) 

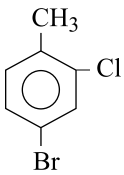
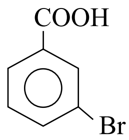
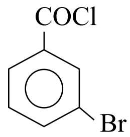
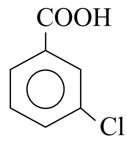
(b) 

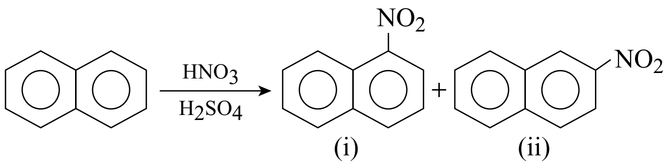
(c) 

(d) 

6. The final product of the given reaction is

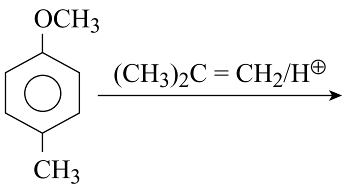


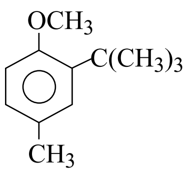
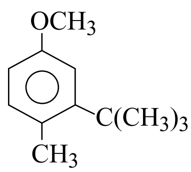
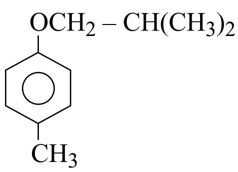
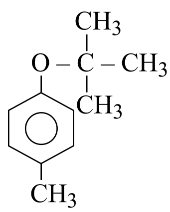
(a) 
(b) 
(c) 
(d) 

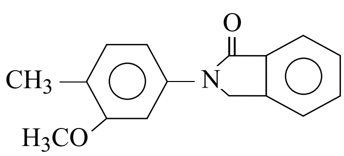
7. 

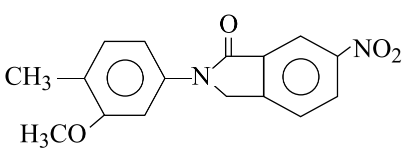
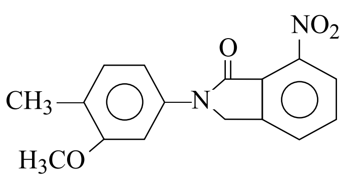
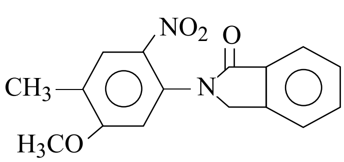
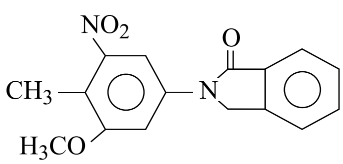
Which statement is correct?

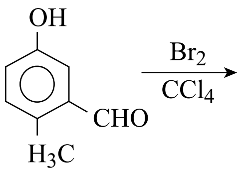
(a) i form in large quantity
(b) ii form in large quantity
(c) i, ii form in equal quantity
(d) naphthalene does not show nitration

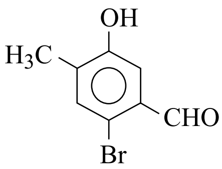
8.  Major product is

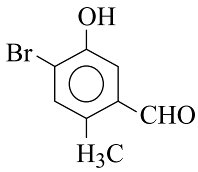
(a) 
(b) 
(c) 
(d) 

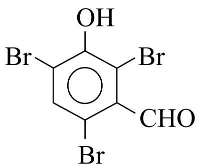
9. Nitration of the compound  gives

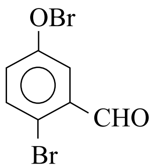
(a) 
(b) 
(c) 
(d) 

10.  A; A can be

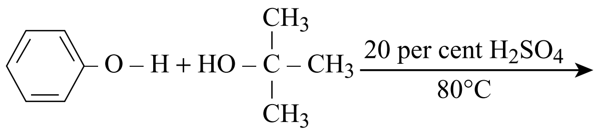
(a) 

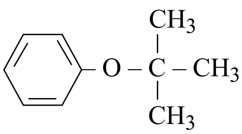
(b) 

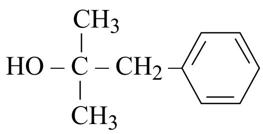
(c) 

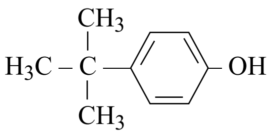
(d) 

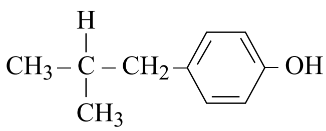
11. The major product of the following reaction is

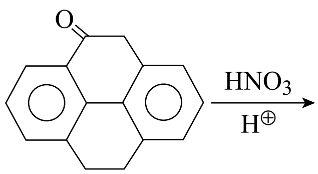


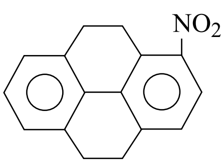
(a) 

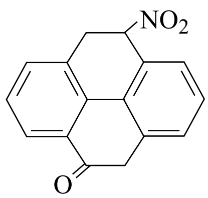
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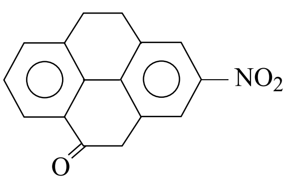
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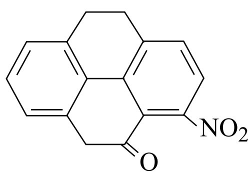
(d) 

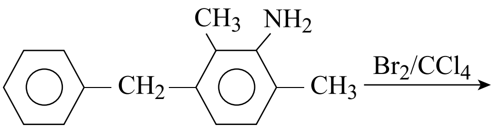
12.  Major product is

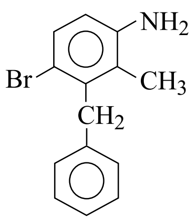
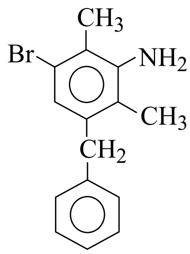
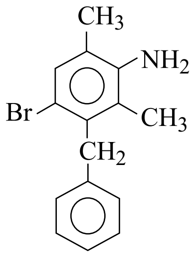
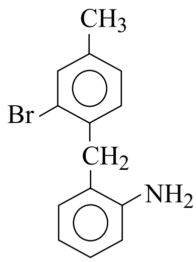
(a) 

(b) 

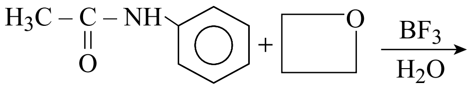
(c) 

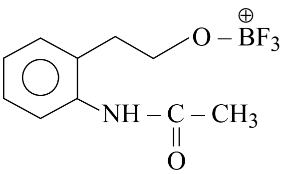
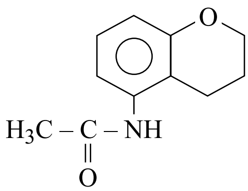
(d) 

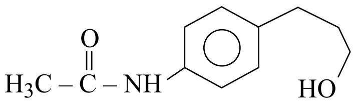
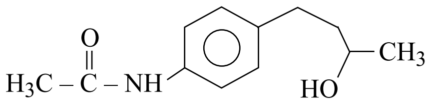
13.  Major product is

(a)  (b)  (c)  (d) 

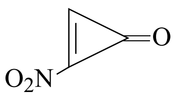
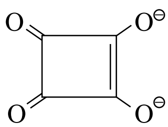
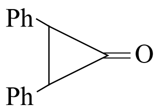
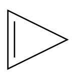
14. The product of the following reaction is



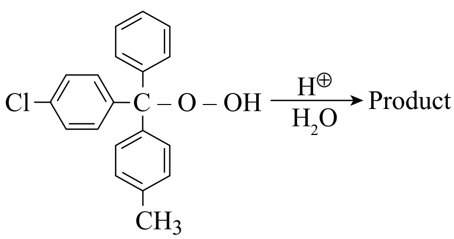
(a)  (b) 

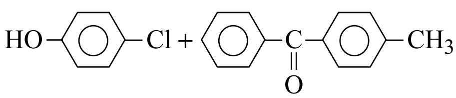
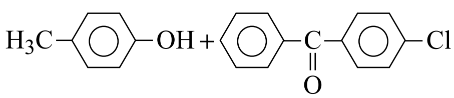
(c)  (d) 

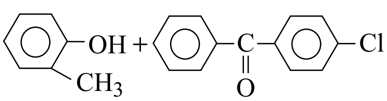
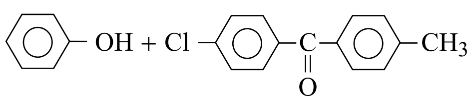
15. Which has equal carbon–carbon bond length?

(a)  (b)  (c)  (d) 

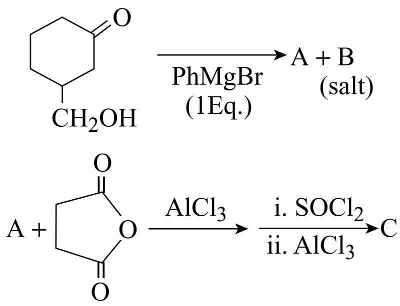
16. Product of the reaction is

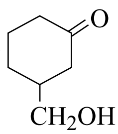


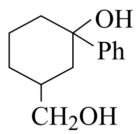
(a)  (b) 

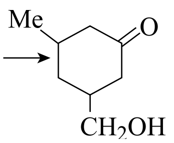
(c)  (d) 

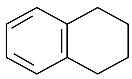
17. For the following reaction, correct options are



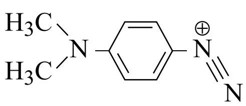
(a) B (salt) + $H_3O^{\oplus}$ ⟶ 

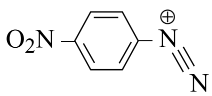
(b) B (salt) + $H_3O^{\oplus}$ ⟶ 

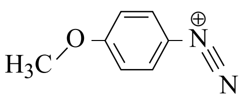
(c) B (salt) + $H_3O^{\oplus}$ ⟶ 

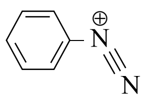
(d) C is 

18. Consider the following ions

(i) 

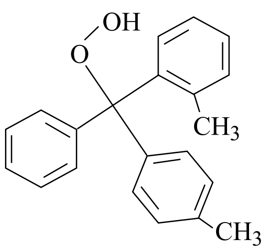
(ii) 

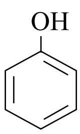
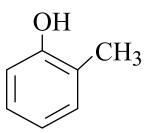
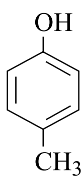
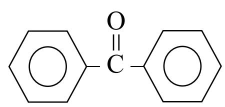
(iii) 

(iv) 

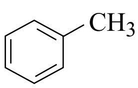
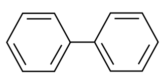
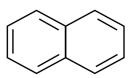
The reactivities of these ions in azo-coupling reactions (under similar conditions) will be such that

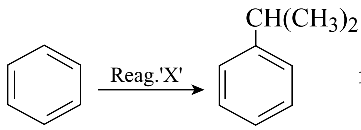
(a) i < iv < ii < iii (b) i < iii < iv < ii (c) iii < i < ii < iv (d) iii < i < iv < ii

19.  $\xrightarrow{H^{\oplus}}$ [A]; [A] is

(a)  (b)  (c)  (d) 

20. Which of the following is/are more reactive towards nitration than benzene?

(a)  (b)  (c)  (d) All of these

21.  is; where the reagent 'X' is

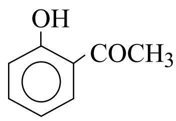
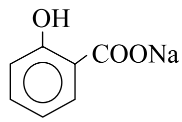
(major product)

(a) $CH_2=CH—CH_3/HF$ (b) $CH_3CH_2CH_2Cl$/Anh. $AlCl_3$

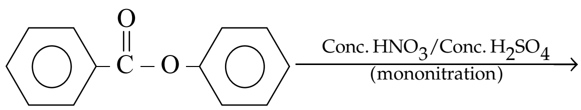
(c) $CH_3-\underset{|}{\overset{}{C}}HCH_3$/Anh. $AlCl_3$ (Cl on central C) (d) All of these

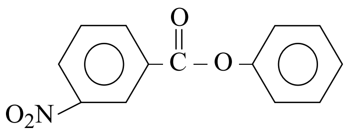
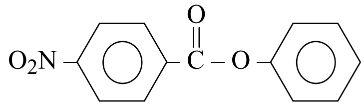
22. In the given reaction sequence

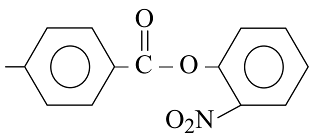
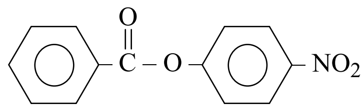
$C_6H_5OCOCH_3 \xrightarrow{AlCl_3/\Delta} (A) \xrightarrow{I_2/NaOH} (B) + CHI_3$, (B) is

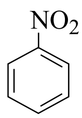
(a) C_6H_5COONa (b) C_6H_5COOH (c)  (d) 

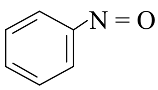
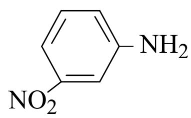
23. The major product formed in the reaction is

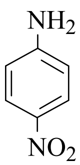
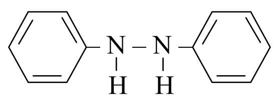


(a)  (b) 

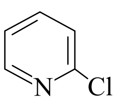
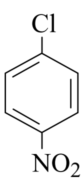
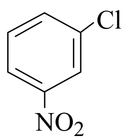
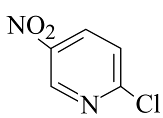
(c)  (d) 

24.  $\xrightarrow{Fe/HCl}$ (A) $\xrightarrow[H_2SO_4]{HNO_3}$ (B). The major product (b) is

(a)  (b) 

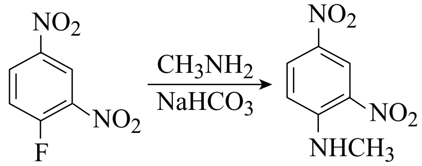
(c)  (d) 

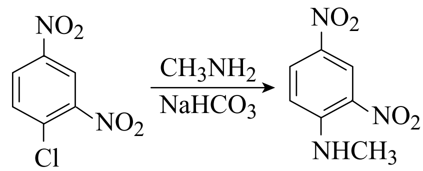
25. Arrange the following in the order of their nucleophilic substitution reaction

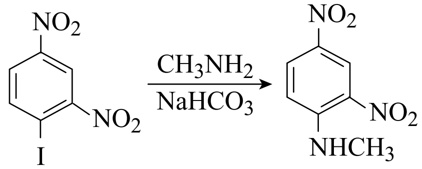
(i)  (ii)  (iii)  (iv) 

(a) ii > iv > i > iii (b) i > iv > ii > iii (c) iv > i > ii > iii (d) iv > ii > i > iii

26. For the following reaction

(i) 

(ii) 

(iii) 

Correct order of reactivity

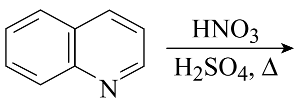
(a) i = ii = iii (b) i > ii > iii (c) i < ii < iii (d) ii > iii > i

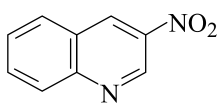
27. What is correct order of rate of nitration of the following compounds?

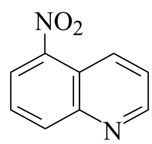
(i) $C_6H_5CH_3$ (ii) C_6H_6 (iii) C_6H_5Br

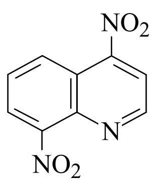
(iv) $C_6H_5\overset{\oplus}{N}R_3$ (v) $C_6H_5NMe_2$

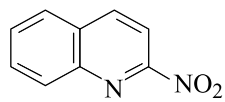
(a) iv > iii > ii > i > v
(b) v > iii > ii > i > iv
(c) v > i > ii > iii > iv
(d) v > iv > ii > i > iii

28. Identify the product 

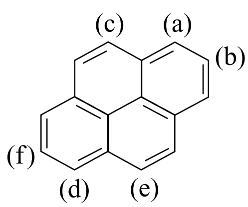
(a) 

(b) 

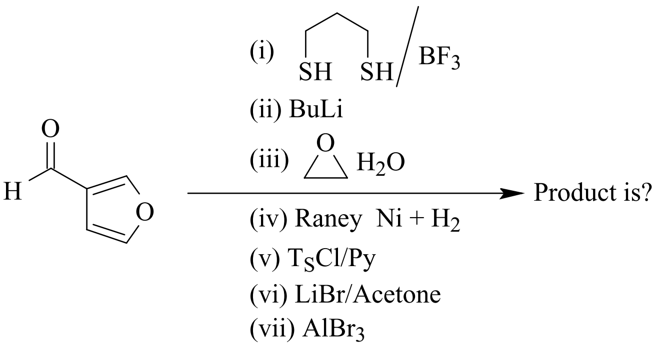
(c) 

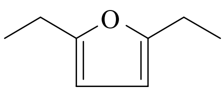
(d) 

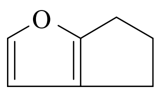
29. Which centre (s) more reactive towards EAS in the given molecule?

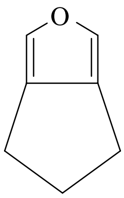


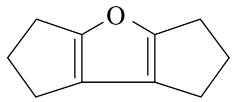
(a) a (b) d (c) c (d) e

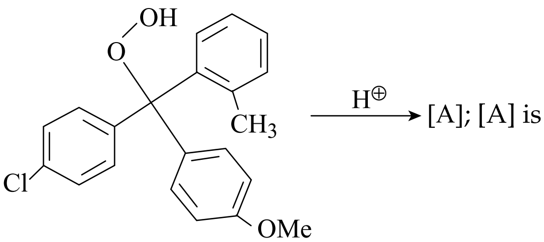
30. 

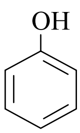
(a) 

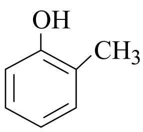
(b) 

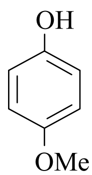
(c) 

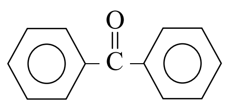
(d) 

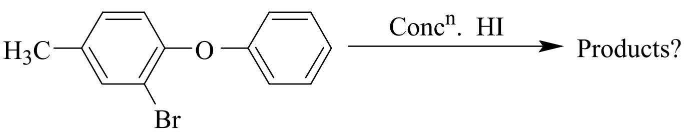
31. 

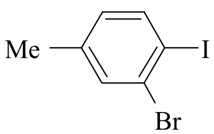
(a) 

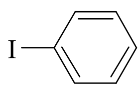
(b) 

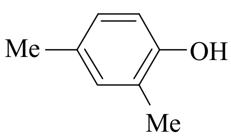
(c) 

(d) 

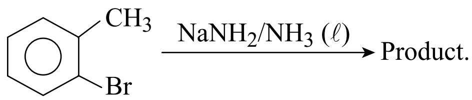
32. 

(a) 

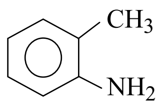
(b) 

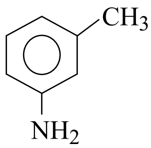
(c) 

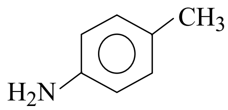
(d) No Reaction

33. 

Product is

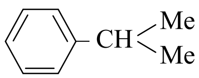
(a) 

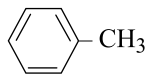
(b) 

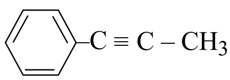
(c) 

(d) Mixture of (a) and (b)

34. Which compound on oxidation with acidified $KMnO_4$ solution gives benzoic acid?

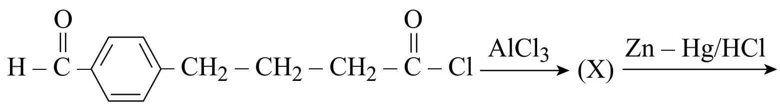
(a) 

(b) 

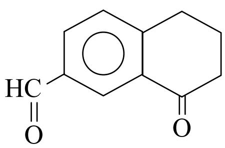
(c) 

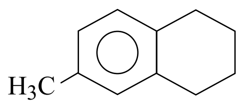
(d) All of these

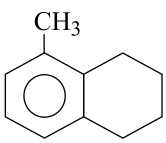
35. In the given reaction

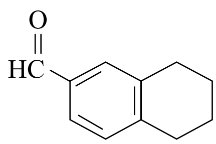


(Y); The final product (Y) is

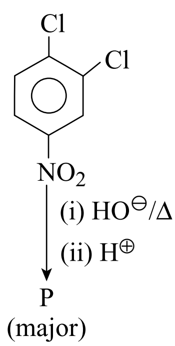
(a) 

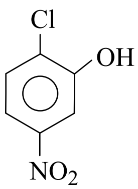
(b) 

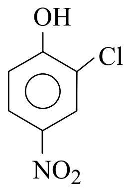
(c) 

(d) 

36. Based on the following reaction, the major product would be



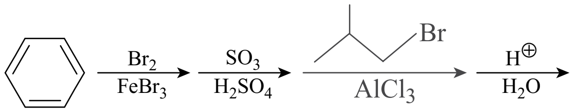
(a) 

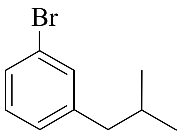
(b) 

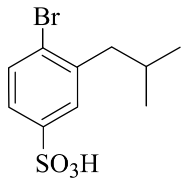
(c) Both in equal proportions

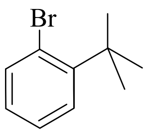
(d) None of these

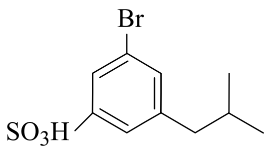
37. Give the major product from the following reaction sequence

 Major product

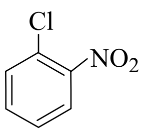
(a) 

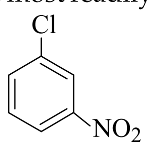
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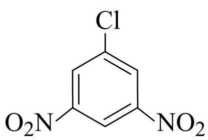
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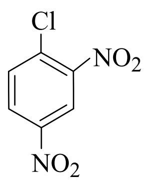
(d) 

38. Which one of the following compounds will be most readily hydrolyzed in aqueous alkali?

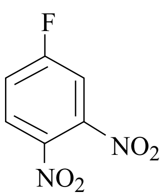
(a) 

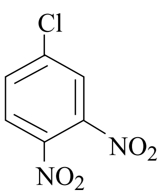
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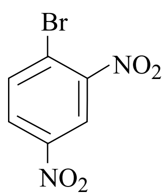
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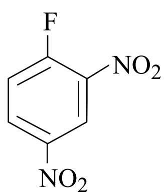
(d) 

39. Which of the following is most reactive towards the reaction with NaOMe?

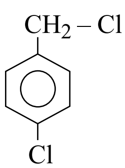
(a) 

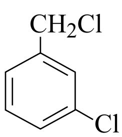
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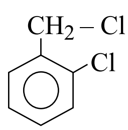
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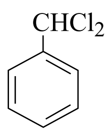
(d) 

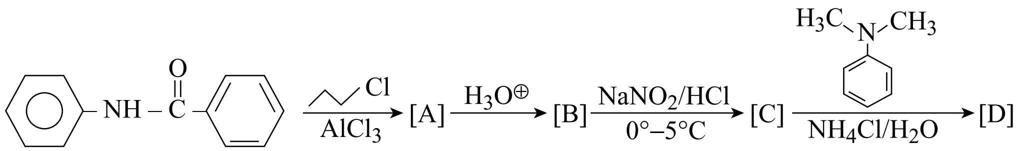
40. An aromatic compound 'A' $C_7H_6Cl_2$, gives AgCl on boiling with alcoholic $AgNO_3$ solution and yields C_7H_7OCl on treatment with NaOH. 'A' on oxidation gives monochloro benzoic acid which affords only one mononitro derivative. The compound 'A' is

(a) 

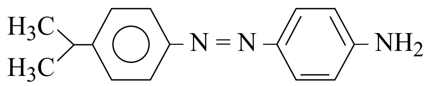
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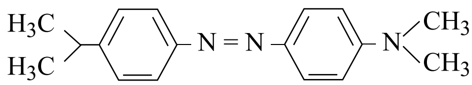
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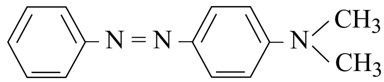
(d) 

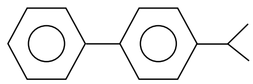
41. 

Product [D] is

(a) 

(b) 

(c) 

(d) 

42. Identify B, X and R respectively in the following sequence of reactions

$C_2H_5MgBr \xrightarrow{ClCN} A \xrightarrow{H_3O^+} \boxed{B}$,

$CH_3COCH_3 \xrightarrow[NaOH]{I_2} \boxed{X} \xrightarrow{Ag} Y$

$C_6H_5NH_2 \xrightarrow[HCl]{NaNO_2} P \xrightarrow{CuCN} Q \xrightarrow{+4H} \boxed{R}$

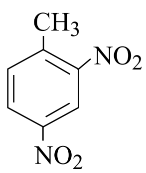
(a) C_2H_5COOH, CHI_3, $C_6H_5CH_2NH_2$

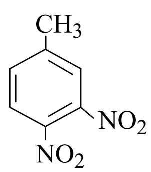
(b) C_2H_5COOH, CH_3I, C_6H_5COOH

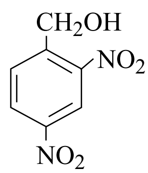
(c) $C_2H_5CH_2NH_2$, CH_3I, C_6H_5COOH

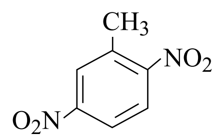
(d) C_2H_5COOH, C_2H_5I, $C_6H_5CONH_2$

43. p-nitrotoluene on further nitration gives

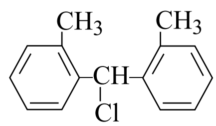
(a) 

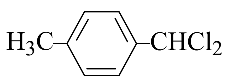
(b) 

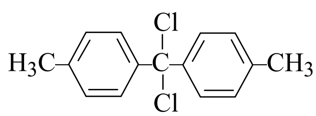
(c) 

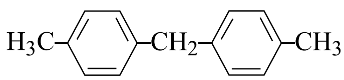
(d) 

44. Which of the following structures correspond to the product expected, when excess of toluene reacts with CH_2Cl_2 in presence of anhydrous $AlCl_3$?

(a) 

(b) 

(c) 

(d) 

45. In the sulphonation, acetylation and formylation of benzene the group of effective electrophiles would be

(a) $SO_3^{\oplus}, CH_3C\equiv\overset{\oplus}{O}, H\overset{\oplus}{C}O$

(b) SO_3, $CH_3C\equiv\overset{\oplus}{O}, H\overset{\oplus}{C}O$

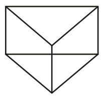
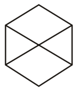
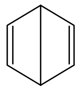
(c) SO_3, CH_3CHO, CO + HCl

(d) HSO_3, CH_3CO, HCO

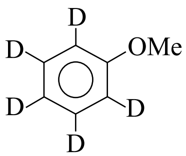
46. When benzene is heated with acetic anhydride in the presence of anhydrous aluminium chloride at 80°C, the product formed is?

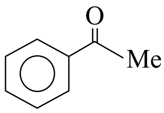
(a) Benzoic acid (b) Benzophenone
(c) Acetophenone (d) Ethyl phenyl ketone

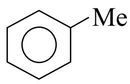
47. Which of the following is not the structural formulae of benzene?

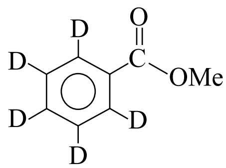
(a)  (b)  (c)  (d) None of these

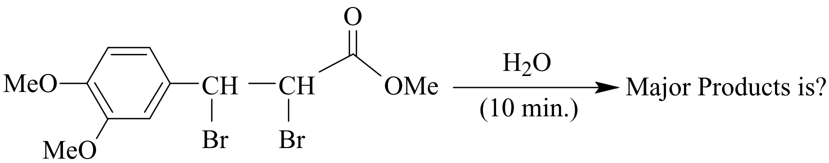
48. Most reactive towards nitration is

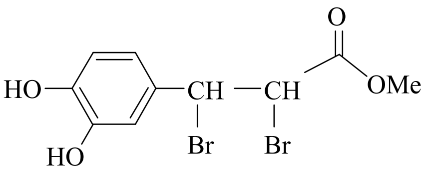
(a) 

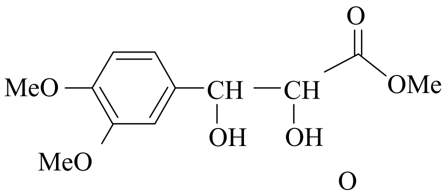
(b) 

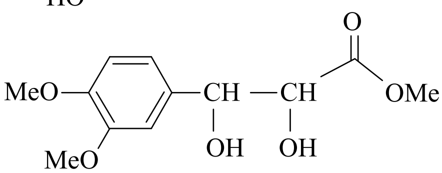
(c) 

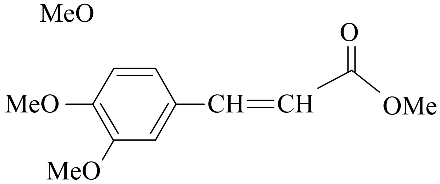
(d) 

49. 

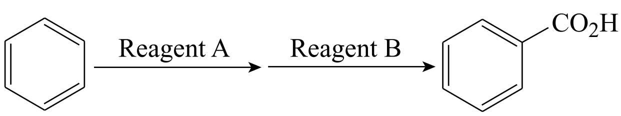
(a) 

(b) 

(c) 

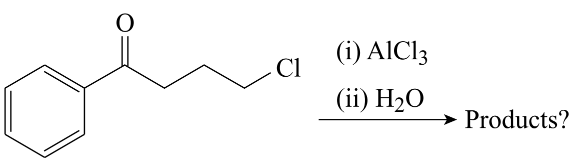
(d) 

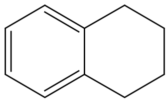
50. What reagents (conditions) are needed for the following reaction?

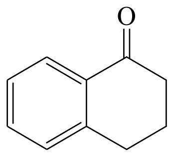


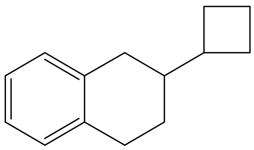
(a) reagent A: $CH_3COCl/AlCl_3$; reagent B: Sn, HCl, heat
(b) reagent A: $CH_3CH_2Cl/AlCl_3$; reagent B: $KMnO_4$, heat
(c) reagent A: $CH_3COCl/AlCl_3$; reagent B: H_2NNH_2, KOH, H_2O, heat
(d) reagent A: HNO_3, H_2SO_4; reagent B: Sn, HCl, heat

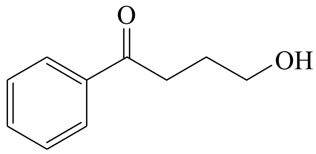
51. What could be the product for the following reaction?



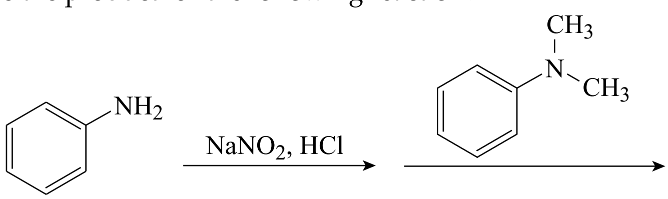
(a) 

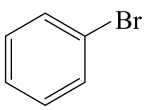
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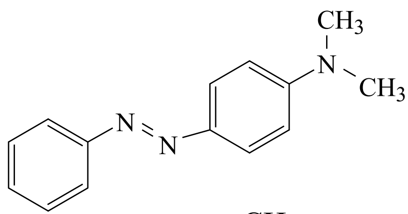
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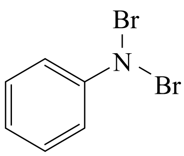
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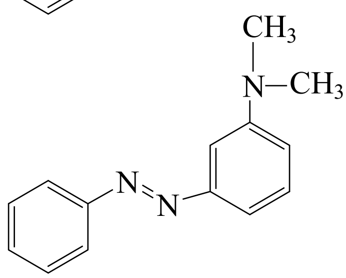
52. What could be the product for the following reaction?



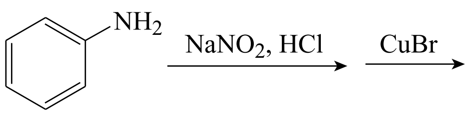
(a) 

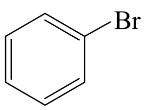
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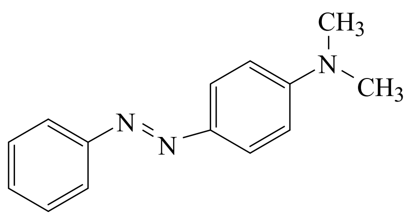
(c) 

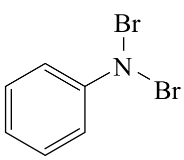
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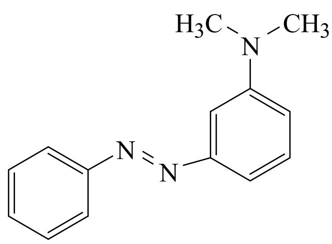
53. What could be the product for the following reaction?



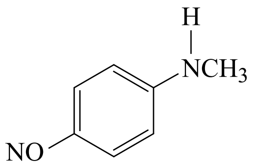
(a) 

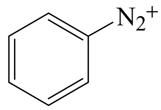
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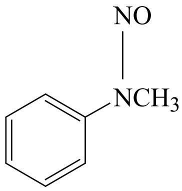
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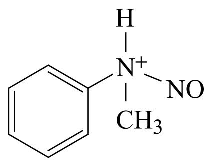
(d) 

54. What could be the product for the following reaction $Ph-NH(Me) \xrightarrow[HCl]{NaNO_2}$?

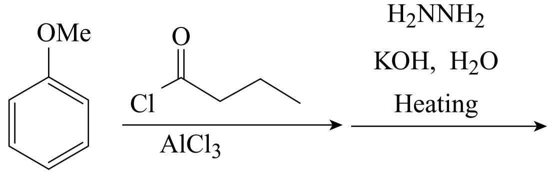
(a) 

(b) 

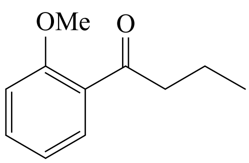
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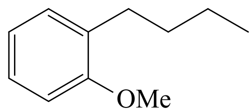
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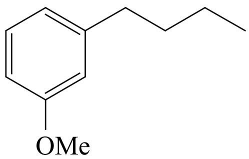
55. What could be the major product for the following reaction?

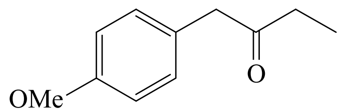


. Major product?

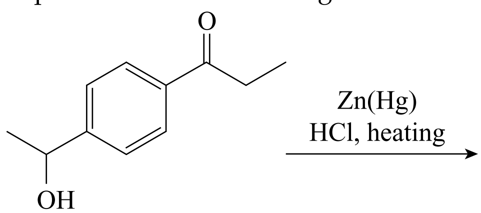
(a) 

(b) 

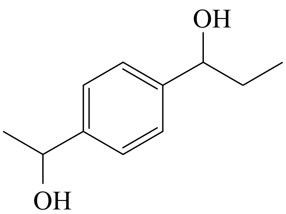
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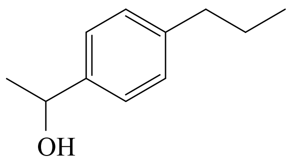
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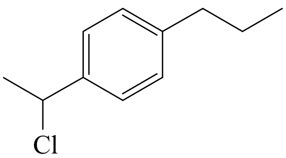
56. What could be the product for the following reaction?

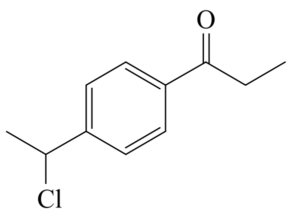


. Major product?

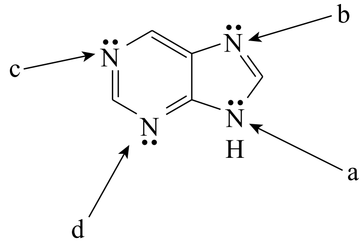
(a) 

(b) 

(c) 

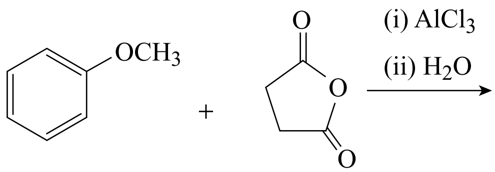
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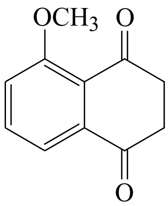
57. For the following compound, which nitrogen is most apt to be protonated?

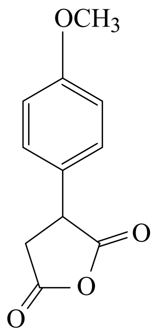


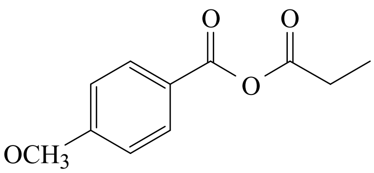
(a) Nitrogen indicated by arrow 'a'
(b) Nitrogen indicated by arrow 'b'
(c) Nitrogen indicated by arrow 'c'
(d) Nitrogen indicated by arrow 'd'

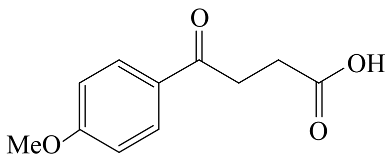
58. What could be the product for the following reaction?



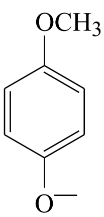
(a) 

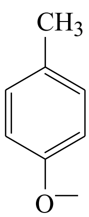
(b) 

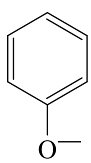
(c) 

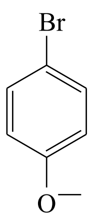
(d) 

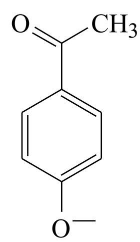
59. What is the correct order of decreasing basicity for the following anions (from the most to the least)?

(i) 

(ii) 

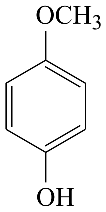
(iii) 

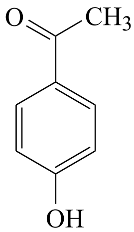
(iv) 

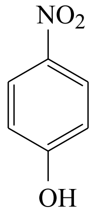
(v) 

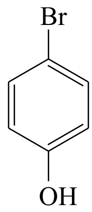
(a) i > ii > iii > iv > v
(b) i > ii > iii > v > iv
(c) i > ii > iv > iii > v
(d) v > iv > iii > ii > i

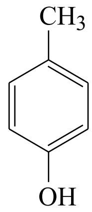
60. What is the correct order of decreasing acidity for the following phenol and phenol derivatives (from the most to the least)?

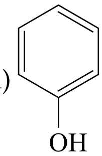
(i) 

(ii) 

(iii) 

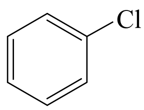
(iv) 

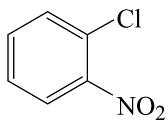
(v) 

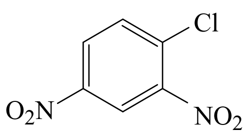
(vi) 

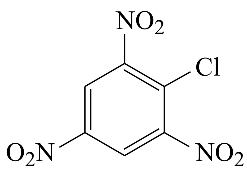
(a) i > ii > iii > iv > v > vi
(b) ii > iii > iv > vi > v > i
(c) iii > ii > iv > vi > v > i
(d) ii > iii > iv > vi > i > v

61. What is the correct order of decreasing reactivity (fastest to slowest) toward nucleophilic aromatic substitution for the following compounds?

(i) 

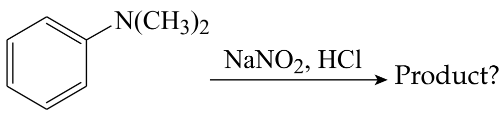
(ii) 

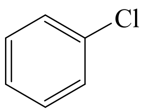
(iii) 

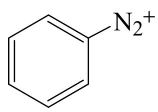
(iv) 

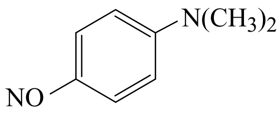
(a) i > ii > iii > iv (b) ii > iii > iv > i (c) iii > ii > iv > i (d) iv > iii > ii > i

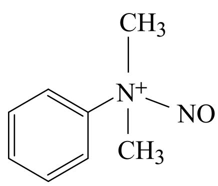
62. What could be the product for the following reaction?



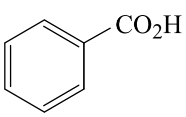
(a) 

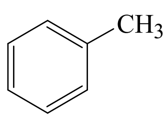
(b) 

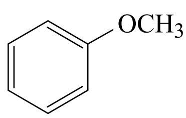
(c) 

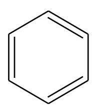
(d) 

63. What is the correct order of decreasing reactivity (fastest to slowest) toward electrophilic aromatic substitution for the following compounds?

(i) 

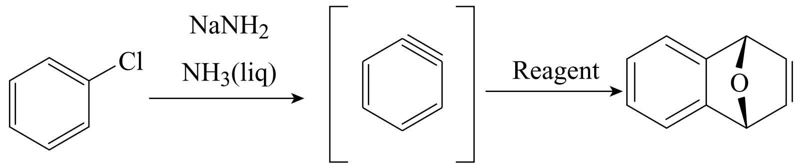
(ii) 

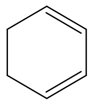
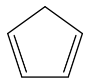
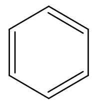
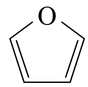
(iii) 

(iv) 

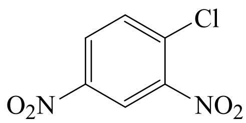
(a) i > ii > iii > iv
(b) ii > i > iv > iii
(c) iii > ii > iv > i
(d) iv > iii > ii > i

64. What could be the reagent for the following reaction?

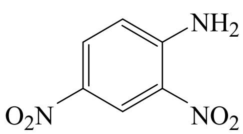


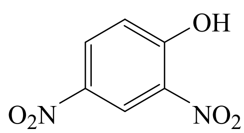
(a)  (b)  (c)  (d) 

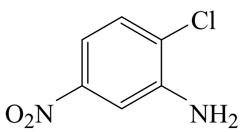
65. What could be the product for the following reaction?

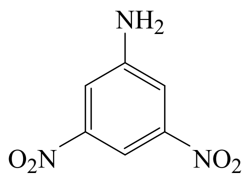


$\xrightarrow[\text{(ii) } OH^{-}/H_2O]{\text{(i) } NH_3\text{, heat}}$ Product?

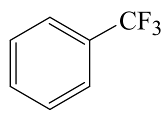
(a) 

(b) 

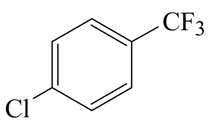
(c) 

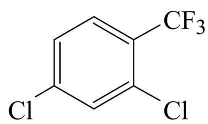
(d) 

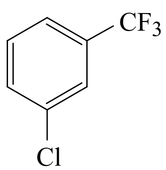
66. Which could be the major product of the following reaction?

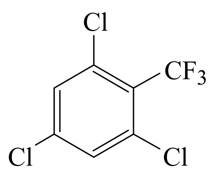


$\xrightarrow{Cl_2,\ FeCl_3}$ Product?

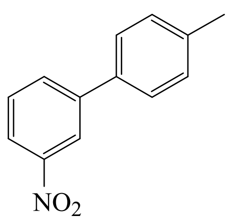
(a) 

(b) 

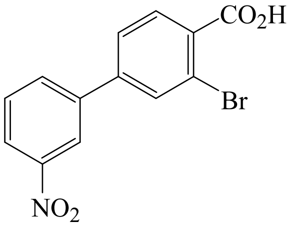
(c) 

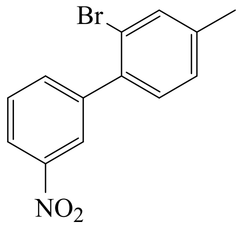
(d) 

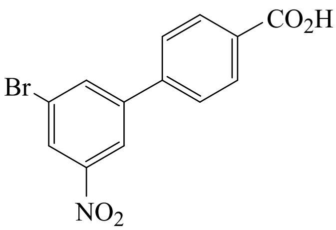
67. Which could be the major product of the following reaction?

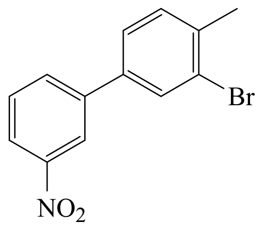


$\xrightarrow[FeCl_3]{Br_2 \text{ (1 equivalence)}}$ $\xrightarrow[\text{Heating}]{K_2Cr_2O_7,\ H_2SO_4}$ Major Product

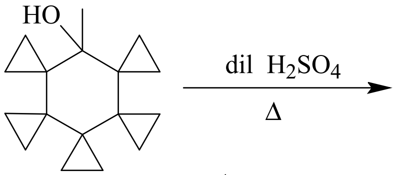
(i) 

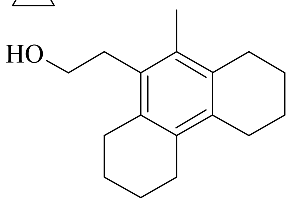
(ii) 

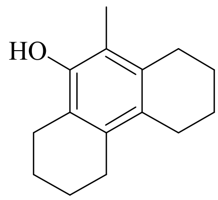
(iii) 

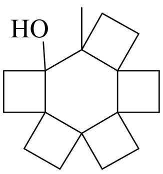
(iv) 

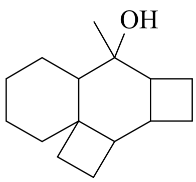
(a) i (b) ii (c) iii (d) iv

68.  Products are?

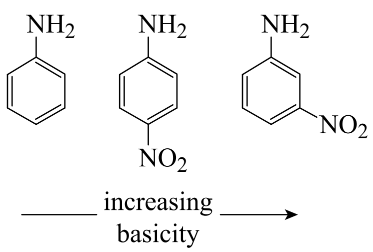
(a) 

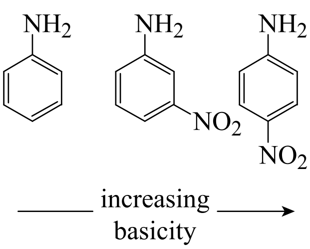
(b) 

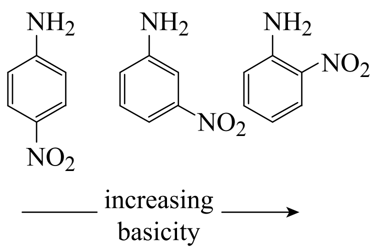
(c) 

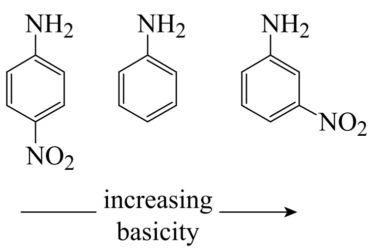
(d) 

69. Choose the order that has the following compounds correctly arranged with respect to increasing basicity.

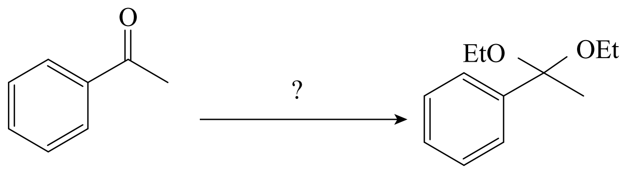
(a) 

(b) 

(c) 

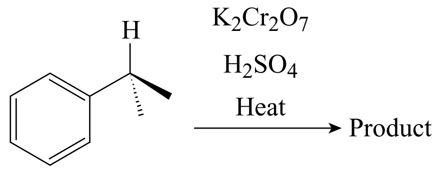
(d) 

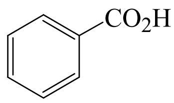
70. What could be the reagent and reaction condition for the following transformation?

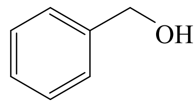


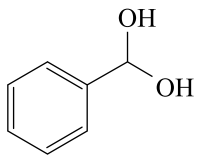
(a) ethanol, NaOH
(b) ethanol, H^+
(c) methanol, NaOH
(d) methanol, H^+

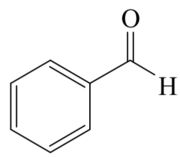
71. What could be the product for the following reaction?



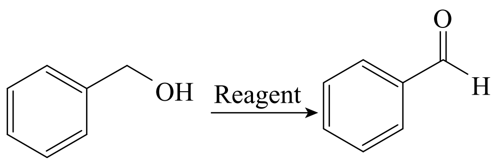
(a) 

(b) 

(c) 

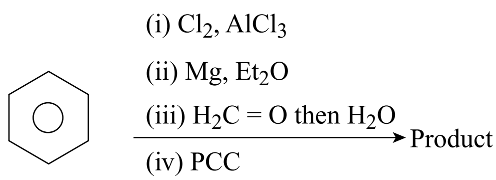
(d) 

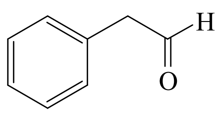
72. What could be the reagent to complete the following reaction?

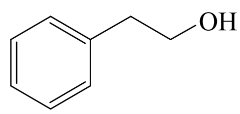


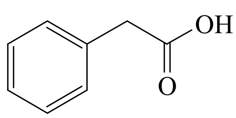
(a) $HCrO_4$
(b) $K_2Cr_2O_7$
(c) PCC in dried CH_2Cl_2
(d) OsO_4

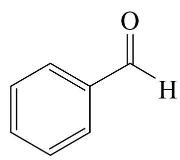
73. What could be the product for the following reaction?



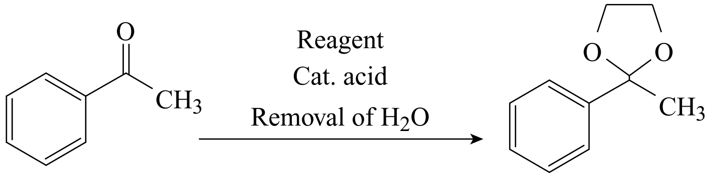
(a) 

(b) 

(c) 

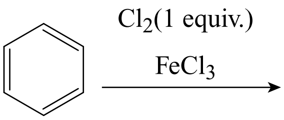
(d) 

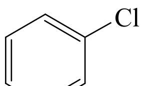
74. What could be the reagent for the following reaction?

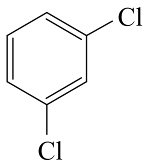


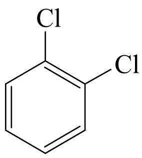
(a) CH_3OH (b) CH_3CH_2OH
(c) CH_3COCH_3 (d) $HOCH_2CH_2OH$

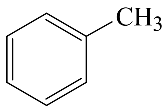
75. What is the expected product for the following reaction?



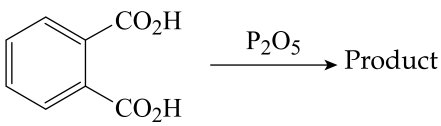
(a) 

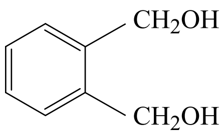
(b) 

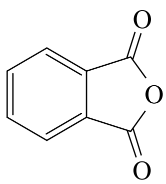
(c) 

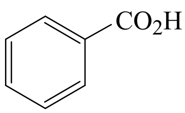
(d) 

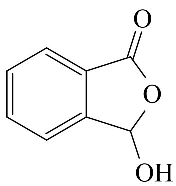
76. What could be the product for the following reaction?



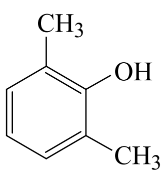
(a) 

(b) 

(c) 

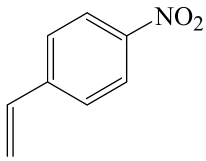
(d) 

77. What is the name of the following compound?



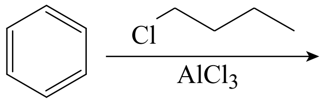
(a) 2,6-Dimethylphenol (b) 1,5-Dimethylphenol
(c) 2,6-Dimethylanisole (d) 1,5-Dimethylanisole

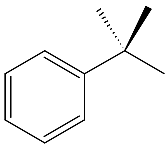
78. What is the name of the following compound?

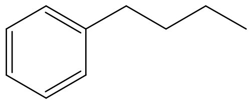


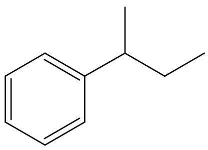
(a) p-aminotoluene
(b) p-nitrotoluene
(c) p-nitrostyrene
(d) 3-aminostyrene

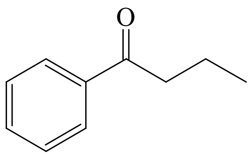
79. What should be the major product for the following reaction?



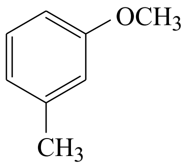
(a) 

(b) 

(c) 

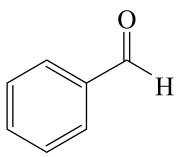
(d) 

80. What is the name of the following compound?



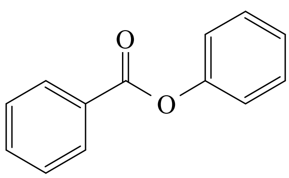
(a) p-methylphenol
(b) m-methylphenol
(c) o-methylanisole
(d) m-methylanisole

81. What is the name of the following compound?



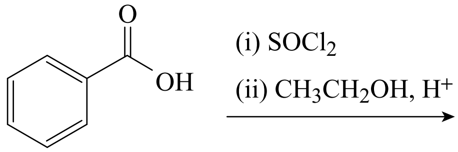
(a) benzylcarbonyl
(b) benzaldehyde
(c) phenylaldehyde
(d) phenylketone

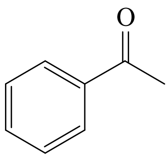
82. What is the name of the following compound?

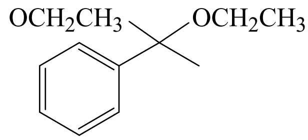


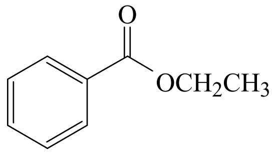
(a) benzyl phenoate (b) phenyl benzoate
(c) benzyl benzoate (d) phenyl phenoate

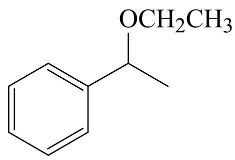
83. What could be the product for the following reaction?



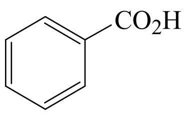
(a) 

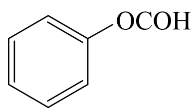
(b) 

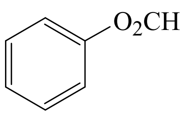
(c) 

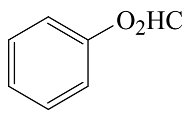
(d) 

84. Which of the following structures is benzoic acid?

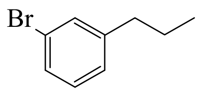
(a) 

(b) 

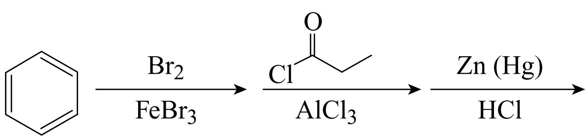
(c) 

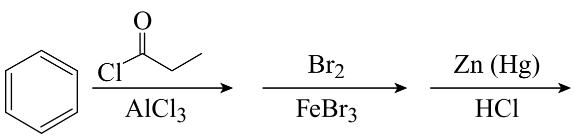
(d) 

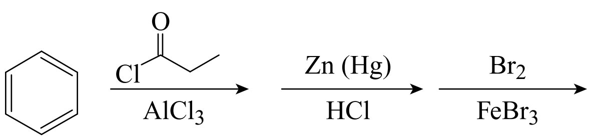
85. Which of the following reaction sequences would be the best for synthesizing the compound, 1-bromo-3-propylbenzene?

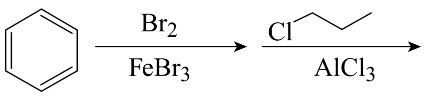


1-Bromo-3-propylbenzene

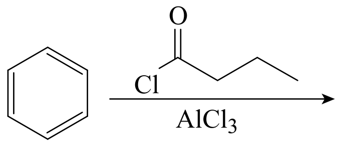
(a) 

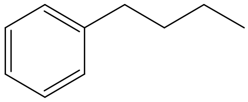
(b) 

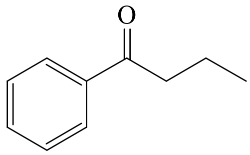
(c) 

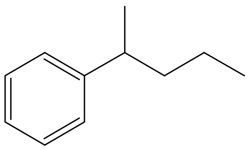
(d) 

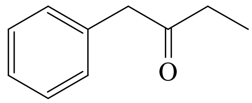
86. What is the expected product for the following reaction?



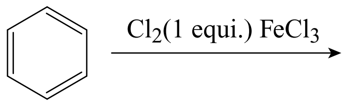
(a) 

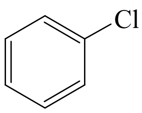
(b) 

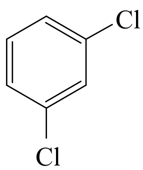
(c) 

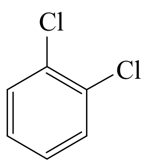
(d) 

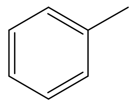
87. What is the expected product for the following reaction?



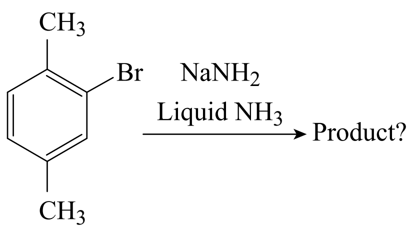
(a) 

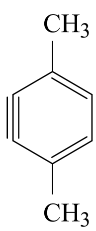
(b) 

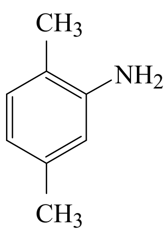
(c) 

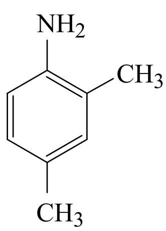
(d) 

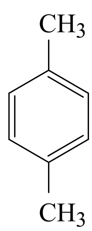
88. What could be the product for the following reaction?



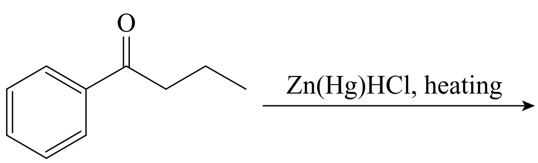
(a) 

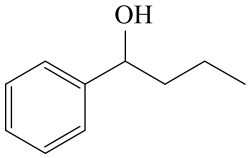
(b) 

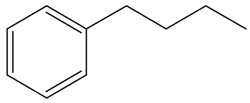
(c) 

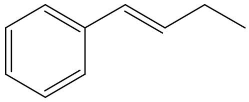
(d) 

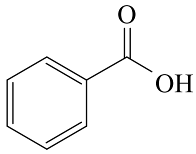
89. What could be the product for the following reaction?

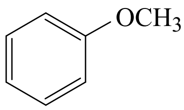


(a) 

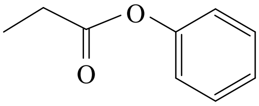
(b) 

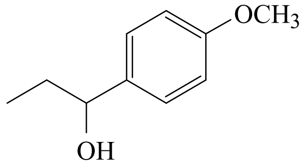
(c) 

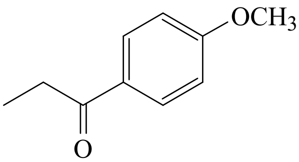
(d) 

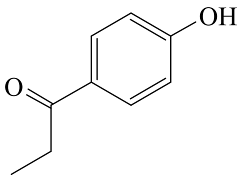
90. 

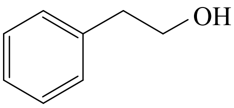
(i) $CH_3CH_2\overset{O}{\overset{\|}{C}}Cl/AlCl_3$
(ii) $LiAlH_4/THF$
$\longrightarrow$
(iii) H_3O^+

(a) 

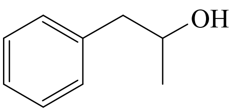
(b) 

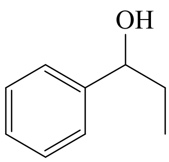
(c) 

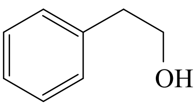
(d) 

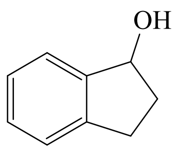
91. 

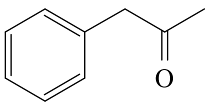
(i) H_2SO_4, heat
$\longrightarrow$?
(ii) CH_3CO_3H
(iii) CH_3MgBr, then H_3O^+

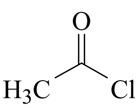
(a) 

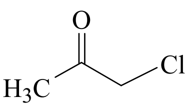
(b) 

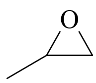
(c) 

(d) 

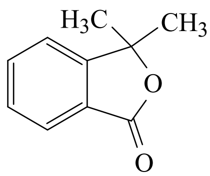
92. 1. Benzyl bromide $\longrightarrow$ 2. Hg^{2+}, H_3O^+ 

(a) 

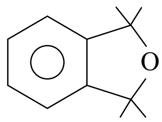
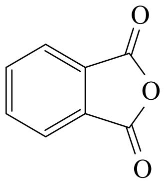
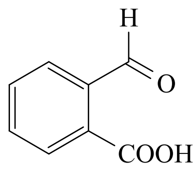
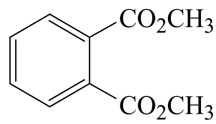
(b) 

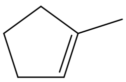
(c) 

(d) $H-C\equiv\overline{C}{:}$

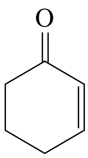
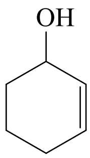
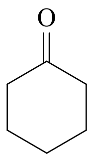
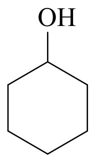
93. 

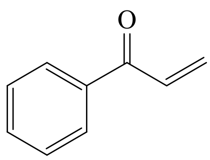
(i) Excess MeMgBr, then H_3O^+ → ?
(ii) Catalytic H^+, heat

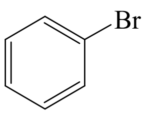
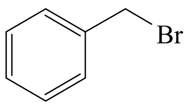
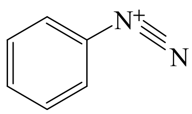
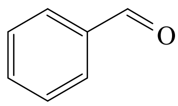
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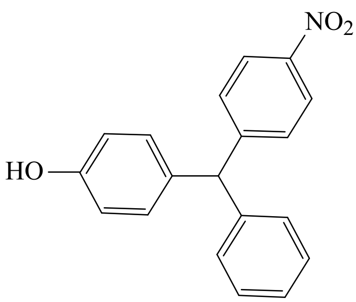
94. 

(i) O_3 →
(ii) Zn, H_2O
(iii) Toluene-4-sulphonic (TOSIC) acid, heat

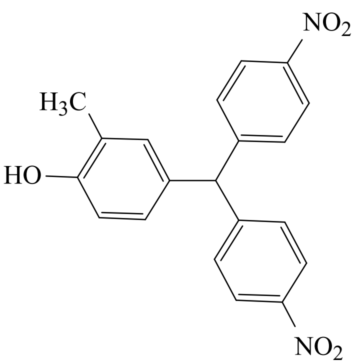
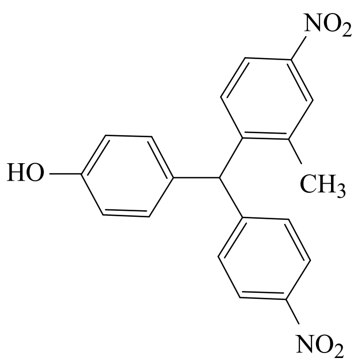
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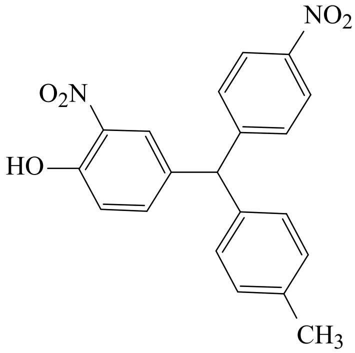
95. ? (i) CuCN → 
(ii) Vinyl lithium, then H_3O^+, heat

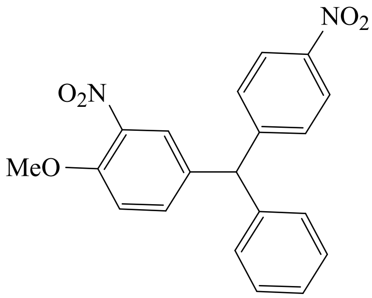
(a)  (b)  (c)  (d) 

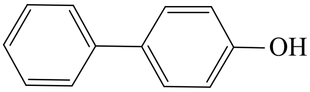
96. 

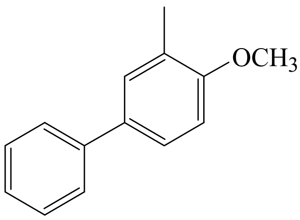
(i) CH_3I, K_2CO_3 →
(ii) H_2SO_4, HNO_3

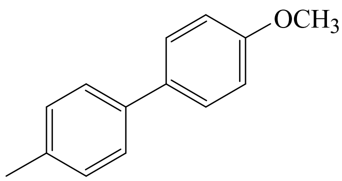
(a)  (b) 

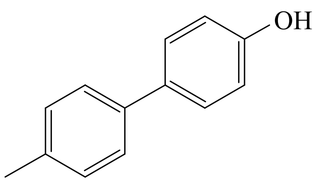
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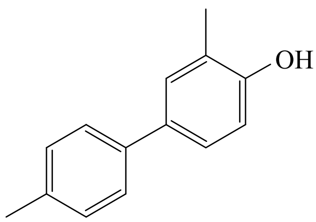
(d) 

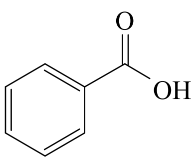
97.  $\xrightarrow[\text{(ii) } CH_3I,\ AlCl_3]{\text{(i) } Na_2CO_3,\ CH_3Br}$ possible products?

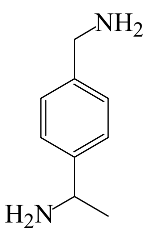
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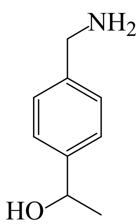
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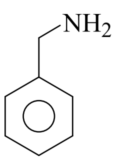
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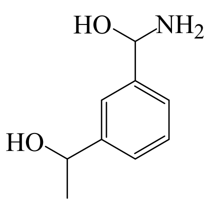
(d) 

98.  (i) Ethanoyl chloride, pyridine → (ii) Excess NH_3 (iii) $LiAlH_4$, then H_3O^+

(a) 

(b) 

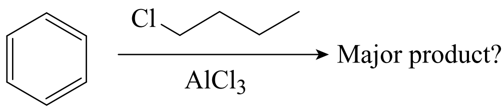
(c) 

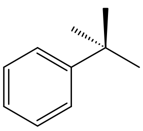
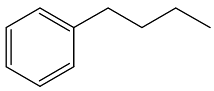
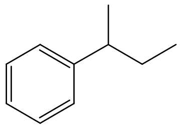
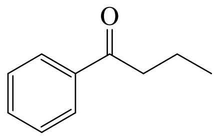
(d) 

LEVEL 2

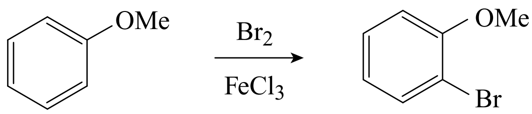
Single and Multiple-choice Type

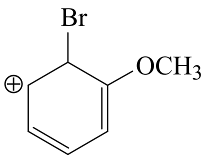
1. What should be the major product for the following reaction?

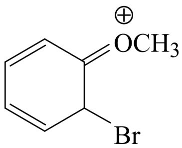


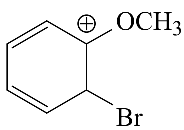
(a)  (b)  (c)  (d) 

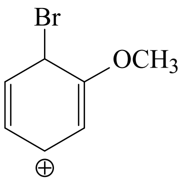
2. Which of the following is not the resonance structure of intermediate from the listed electrophilic aromatic substitution?

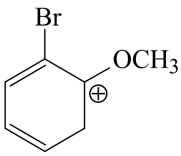


(i) 

(ii) 

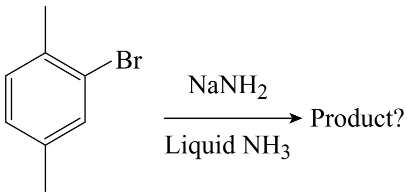
(iii) 

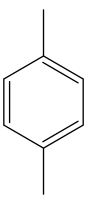
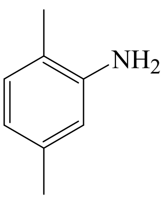
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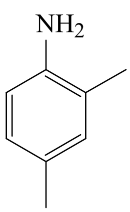
(v) 

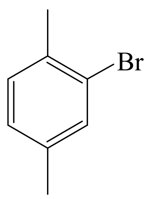
(a) v (b) ii (c) iii (d) iv

3. What could be the product for the following reaction?

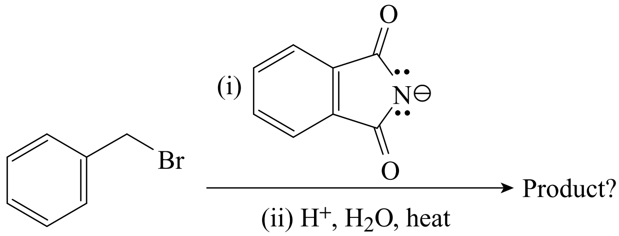


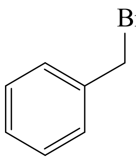
(a)  (b) 

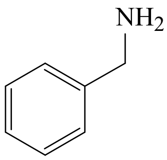
(c) 

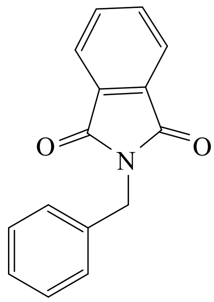
(d) 

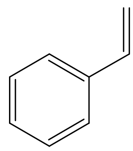
4. What could be the product for the following reaction?



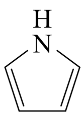
(a) 

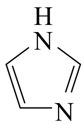
(b) 

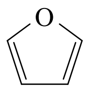
(c) 

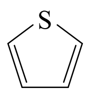
(d) 

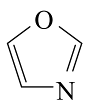
5. Which of the following compounds are aromatic compounds?

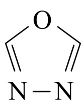
(i) 

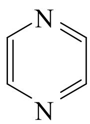
(ii) 

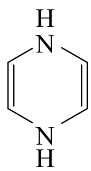
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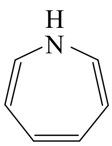
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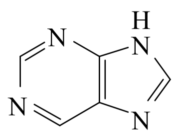
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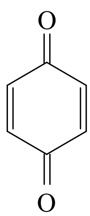
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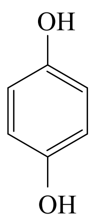
(vii) 

(viii) 

(ix) 

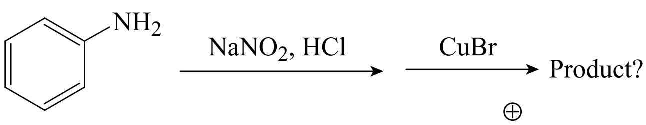
(x) 

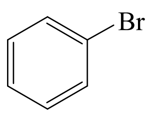
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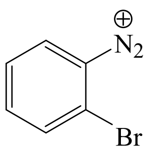
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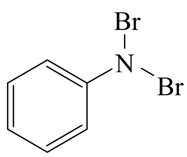
(a) i, ii, iii, iv, v, vi, viii, x, xii
(b) i, ii, iii, v, vii, viii, ix, x, xii
(c) i, ii, iii, vi, viii, x, xi, xii
(d) i, ii, iii, iv, v, vi, vii, x, xii

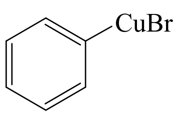
6. What could be the product for the following reaction?



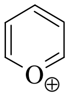
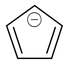
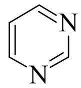
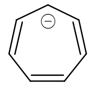
(a) 

(b) 

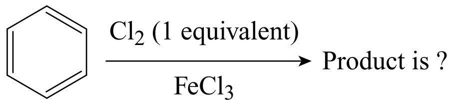
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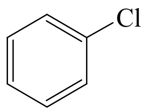
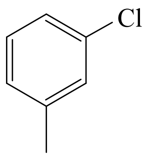
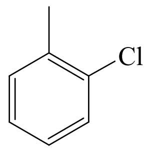
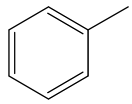
(d) 

7. Which one of the following compounds is antiaromatic?

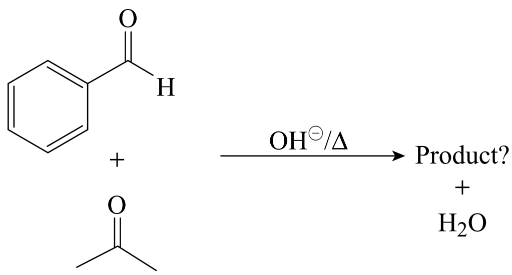
(a) 
(b) 
(c) 
(d) 

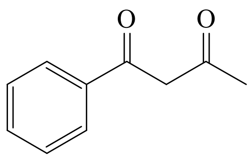
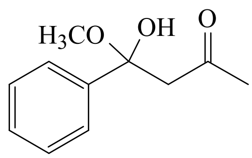
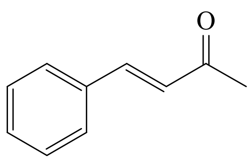
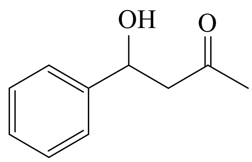
8. What is the expected product for the following reaction?



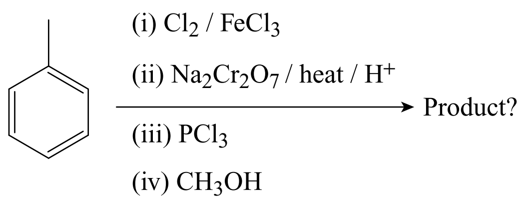
(a) 
(b) 
(c) 
(d) 

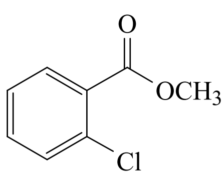
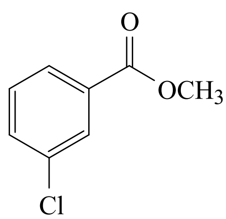
9. What could be the product for the following reaction?

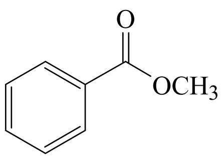


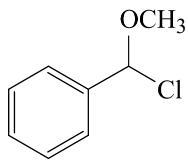
(a) 
(b) 
(c) 
(d) 

10. What could be the product for the following reaction?

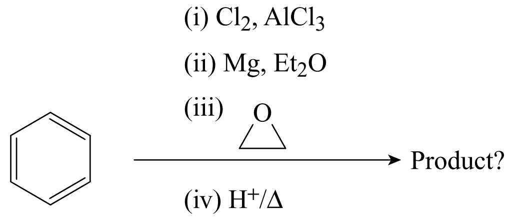


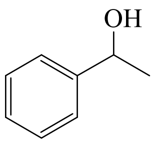
(a) 
(b) 

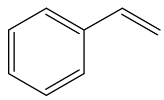
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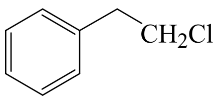
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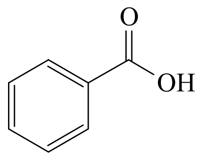
11. What could be the product for the following reaction?



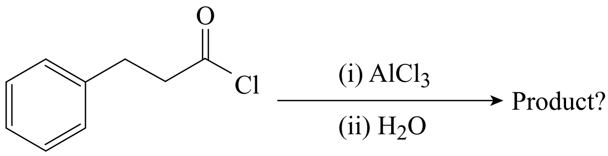
(a) 

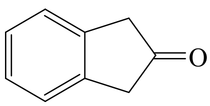
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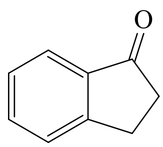
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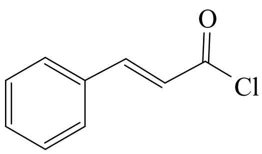
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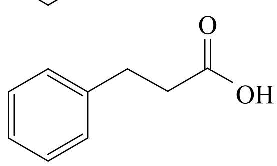
12. What could be the product for the following reaction?



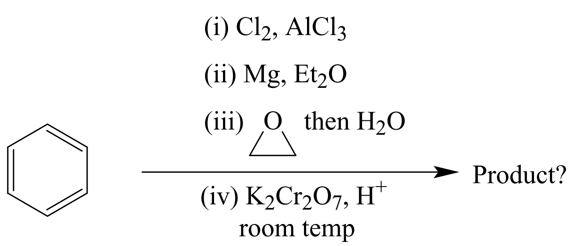
(a) 

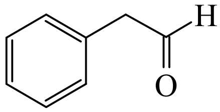
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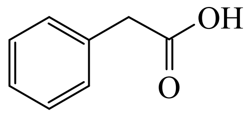
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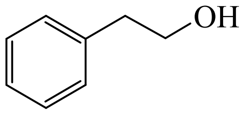
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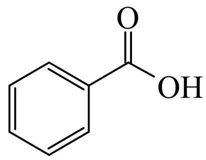
13. What could be the product for the following reaction?



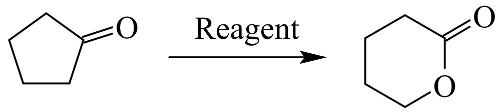
(a) 

(b) 

(c) 

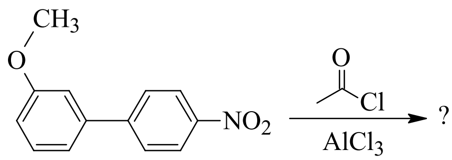
(d) 

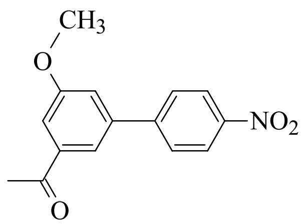
14. What could be the reagent for the following reaction?

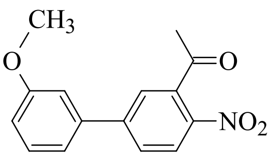


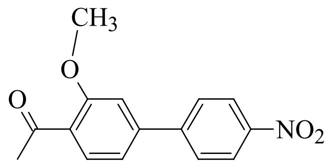
(a) $PhCO_2H$ (b) $PhCO_3H$ (c) OsO_4 (d) $Na_2Cr_2O_7$

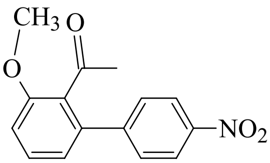
15. Which of the indicated compounds would be the major product in the following Friedel Crafts reaction?



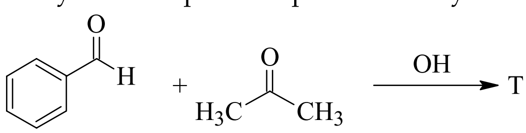
(a) 

(b) 

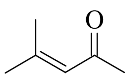
(c) 

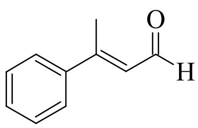
(d) 

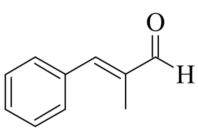
16. The following reaction yields compound T predominately.

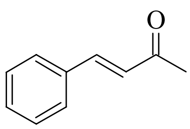


Predict the main product T.

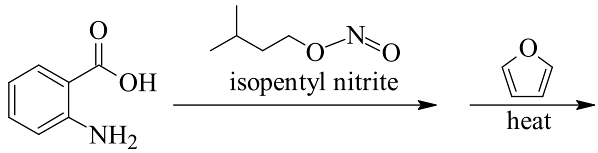
(a) 

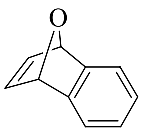
(b) 

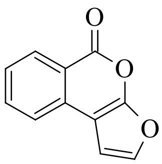
(c) 

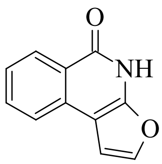
(d) 

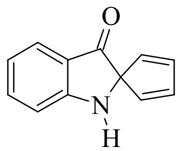
17. The compound isopentylnitrite is a source of NO^+ ions and will react with an amine to generate a diazonium cation. Predict the product of the following reaction sequence.



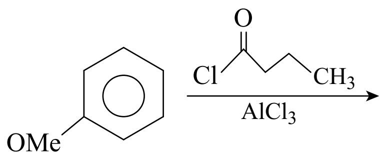
(a) 

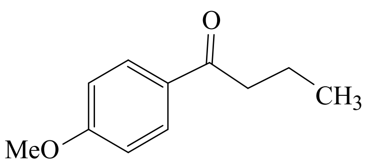
(b) 

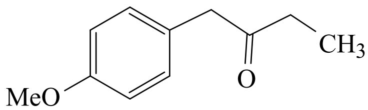
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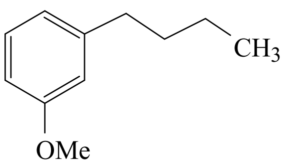
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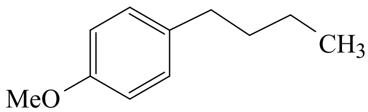
18. What could be the major product for the following Reaction?



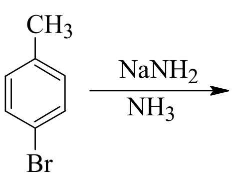
(a) 

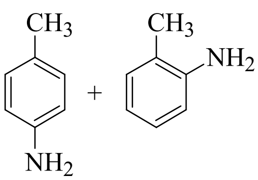
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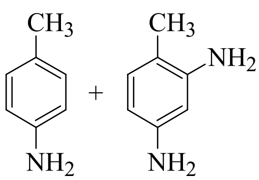
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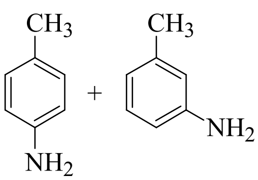
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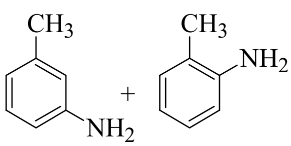
19. The following reaction gives two main products. Identify the products.



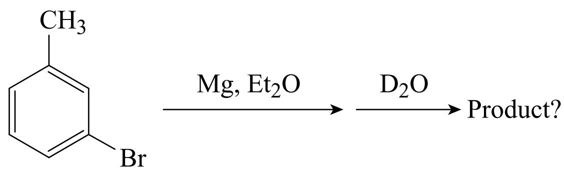
(a) 

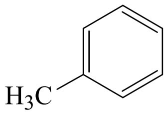
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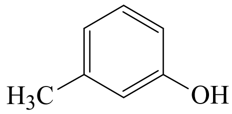
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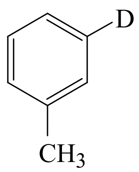
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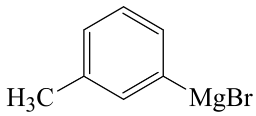
20. What could be the product for the following reaction?



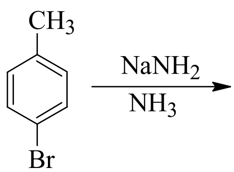
(a) 

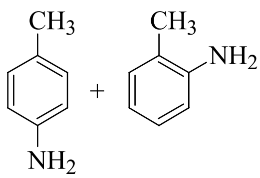
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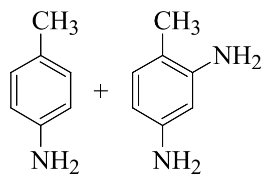
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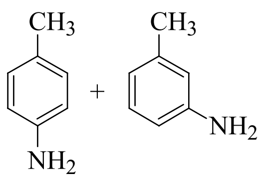
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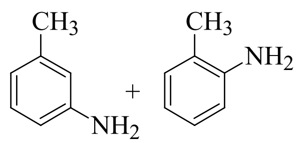
21. The following reaction gives two main products. Identify the products.



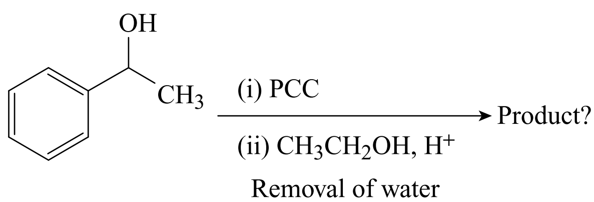
(a) 

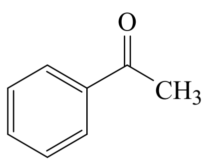
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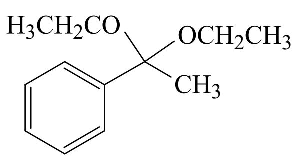
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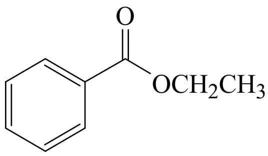
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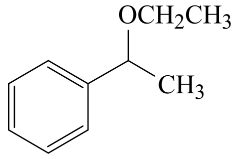
22. What could be the product for the following reaction?



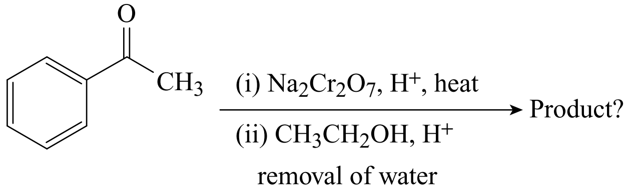
(a) 

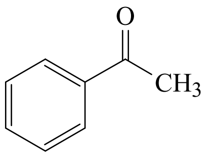
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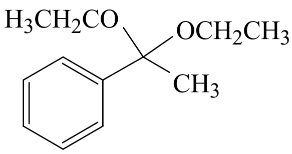
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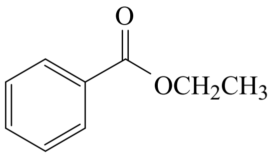
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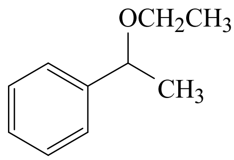
23. What could be the product for the following reaction?



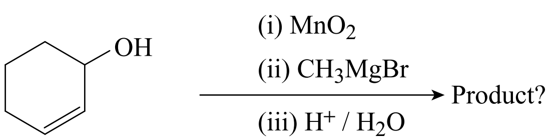
(a) 

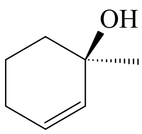
(b) 

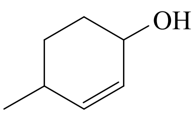
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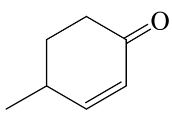
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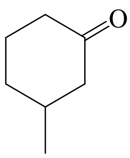
24. What could be the product for the following reaction?



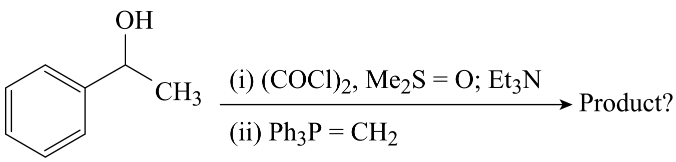
(a) 

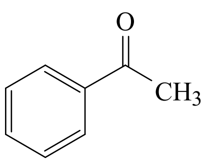
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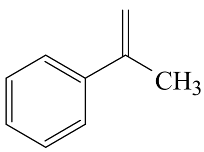
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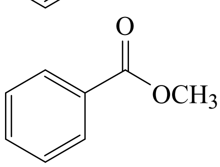
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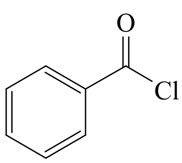
25. What could be the product for the following reaction?



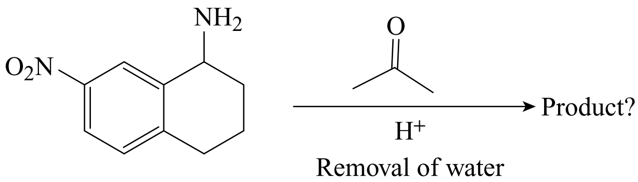
(a) 

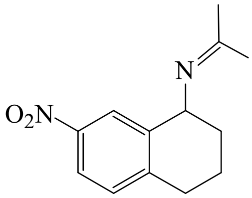
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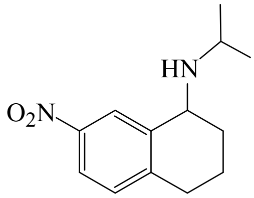
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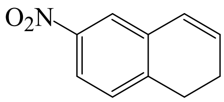
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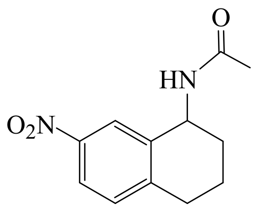
26. What could be the product for the following reaction?



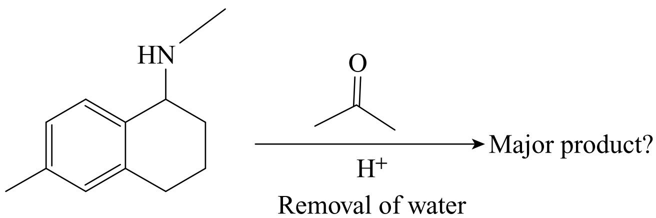
(a) 

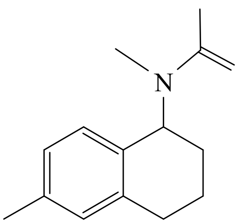
(b) 

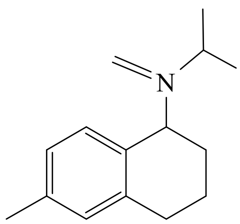
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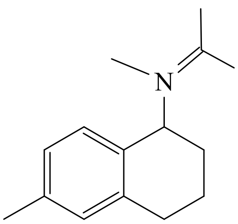
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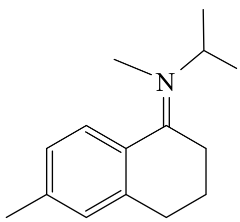
27. What could be the major product for the following reaction?



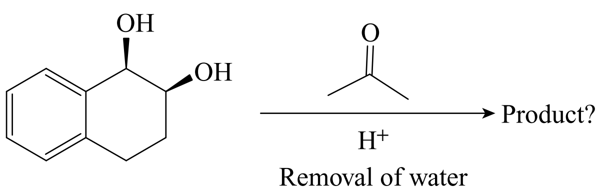
(a) 

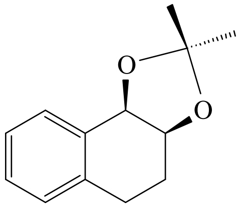
(b) 

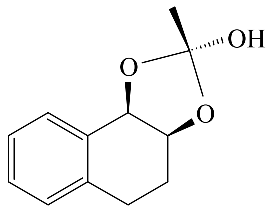
(c) 

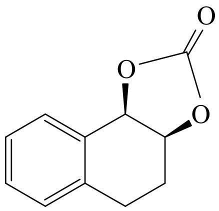
(d) 

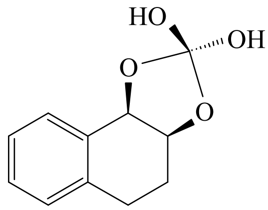
28. What could be the product for the following reaction?



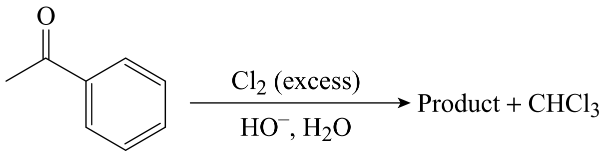
(a) 

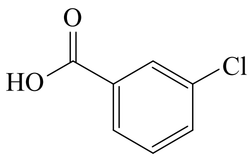
(b) 

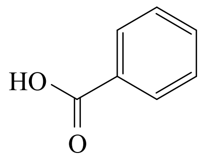
(c) 

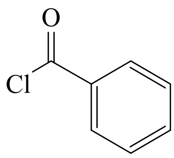
(d) 

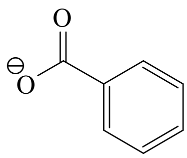
29. What could be the product for the following reaction?



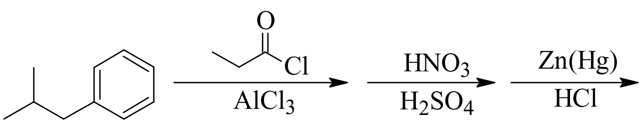
(a) 

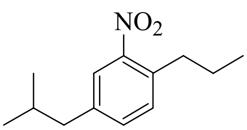
(b) 

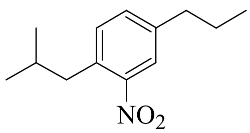
(c) 

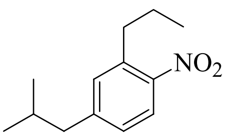
(d) 

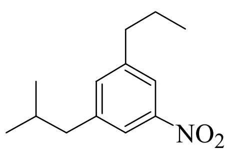
30. Predict the product of the following reaction sequence.



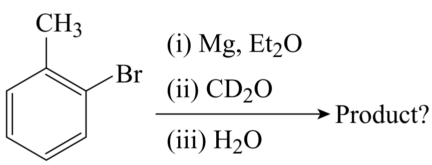
(a) 

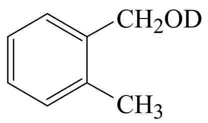
(b) 

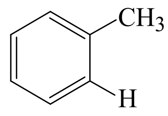
(c) 

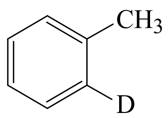
(d) 

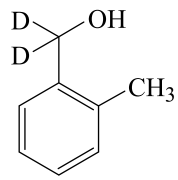
31. What could be the product for the following reaction?



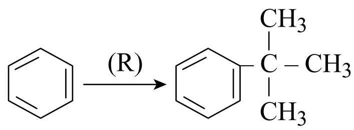
(a) 

(b) 

(c) 

(d) 

32. For the given reaction:

 (R) will be

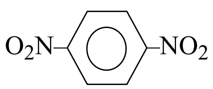
(a) $CH_3-C(CH_3)_2-Br/AlBr_3$

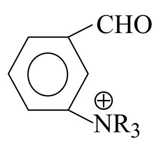
(b) $CH_3-C(CH_3)_2-OH/H^{\oplus}$

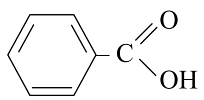
(c) $CH_3-C(CH_3)=CH_2/H^{\oplus}$

(d) $CH_3-CH(CH_3)-CH(Cl)-Ph$

33. Which of the following compound will not give Friedel-Crafts reaction?

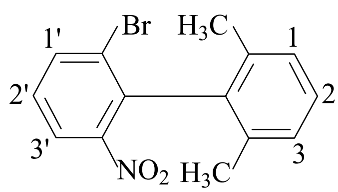
(a) 

(b) 

(c) 

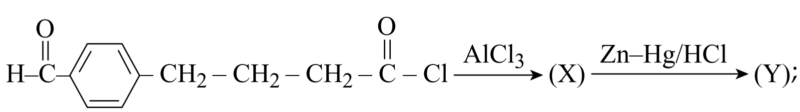
(d) C_5H_5N

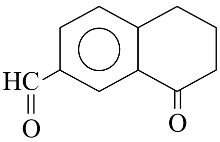
34. In the given reaction, electrophilic substitution will take place readily at the carbon?

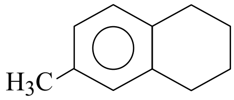


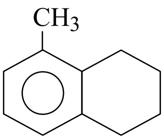
(a) 1′ (b) 1 (c) 3 (d) 3′

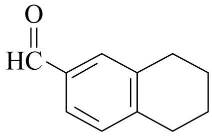
35. In the given reaction

 Choose the correct options.

(a) (X) is 

(b) (Y) is 

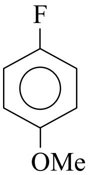
(c) (X) is 

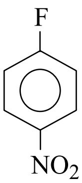
(d) (Y) is 

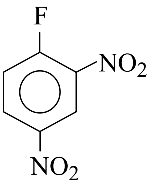
36. The type of substitution reactions of benzenoid hydrocarbons are

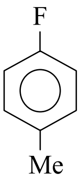
(a) elimination
(b) electrophilic
(c) nucleophilic
(d) free radical

37. Among the following compounds, which liberates F^- on reaction with MeO^-?

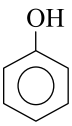
(a) 

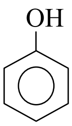
(b) 

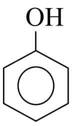
(c) 

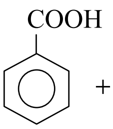
(d) 

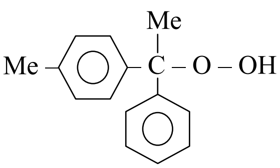
38. Among the following reactions, which form salicylic acid (after acidification)?

(a)  $+ CHCl_3 + NaOH \longrightarrow$

(b)  $+ CCl_4 + NaOH \longrightarrow$

(c)  $+ CO_2 + NaOH \longrightarrow$

(d)  $+ NaOH \longrightarrow$

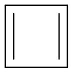
39.  $\xrightarrow{H_3O^{\oplus}} P_1 + P_2$; ($P_2 + FeCl_3 \longrightarrow$ Violet colour)

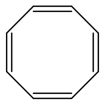
$$P_1 + NaOI \longrightarrow \underset{\text{Yellow}}{P_3\downarrow} + P_4$$

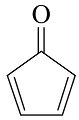
Correct statement for the above sequence is

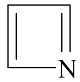
(a) P_3 on reaction with Ag gives acetylene
(b) P_4 on reaction with sodalime gives toluene
(c) P_4 on reaction with sodalime gives benzene
(d) P_1 on reaction with 2,4-DNP gives yellow compound

40. Identify compounds which are unstable at room temperature.

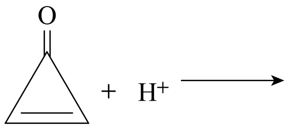
(a) 

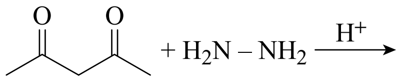
(b) 

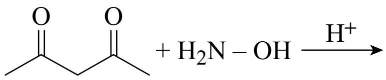
(c) 

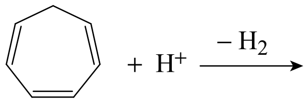
(d) 

41. Identify reactions which give aromatic product.

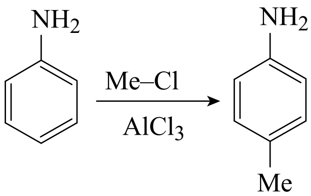
(a) 

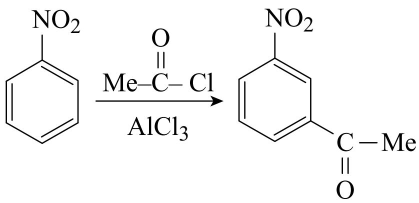
(b) 

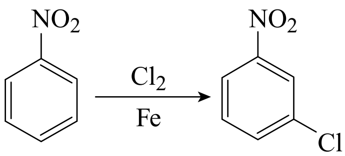
(c) 

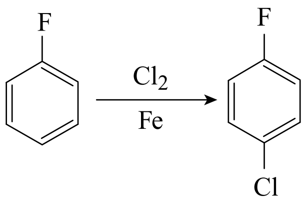
(d) 

42. Identify reactions which are not feasible.

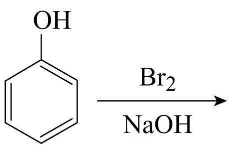
(a) 

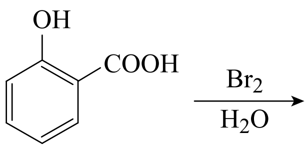
(b) 

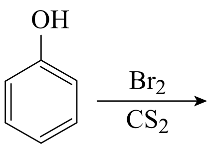
(c) 

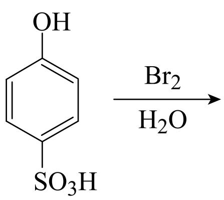
(d) 

43. Identify reactions that give tribromo substituted product.

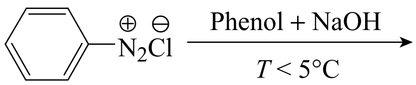
(a) 

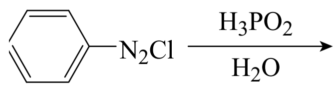
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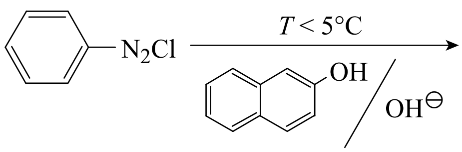
(c) 

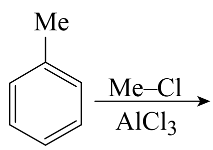
(d) 

44. Identify coupling reactions.

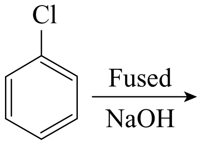
(a) 

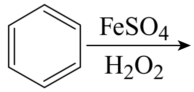
(b) 

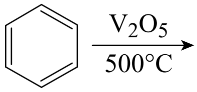
(c) 

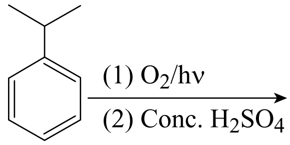
(d) 

45. Identify reactions which give phenol product.

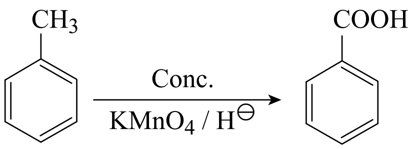
(a) 

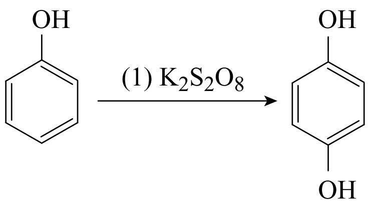
(b) 

(c) 

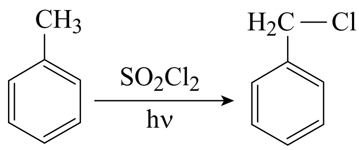
(d) 

46. Identify correctly matched reactions with their products.

(a) 

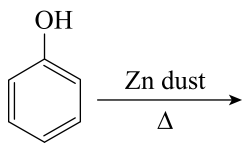
(b) 

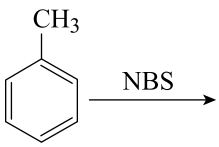
(c) $Ph{-}NH_2 \xrightarrow{Ac_2O} Ph{-}NH{-}Ac$

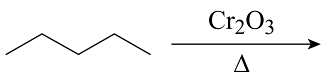
(d) 

47. Identify method of prepration of benzene.

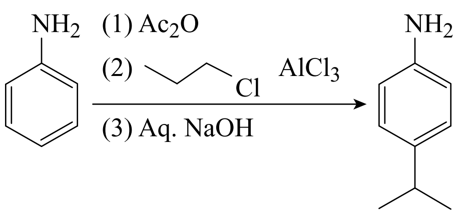
(a) $3CH \equiv CH \xrightarrow[\text{Fe tube}]{\text{Red hot}}$

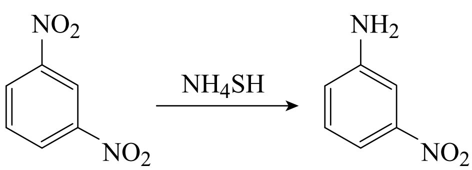
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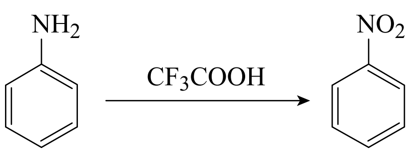
(c) 

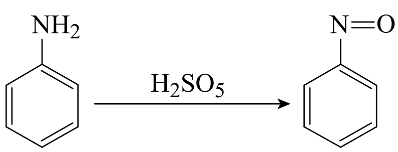
(d) 

48. Identify correctly matched reactions with their products.

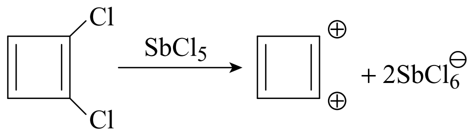
(a) 

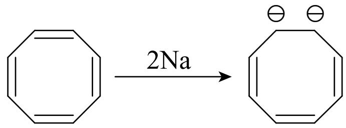
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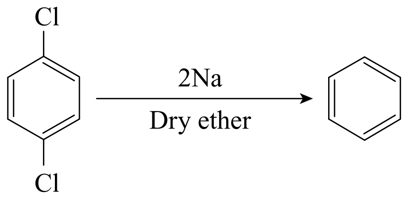
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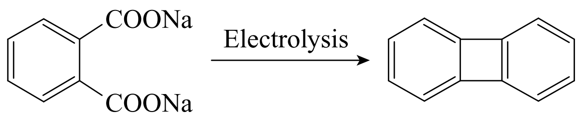
(d) 

49. Identify correctly matched reactions with their products.

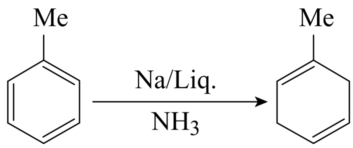
(a) 

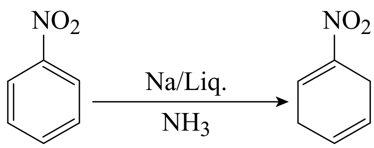
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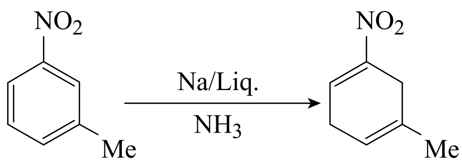
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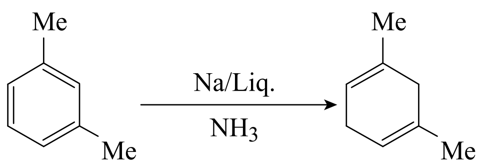
(d) 

50. Identify correctly matched reaction with their products.

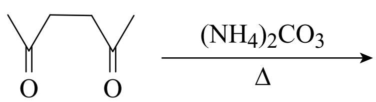
(a) 

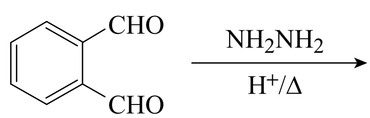
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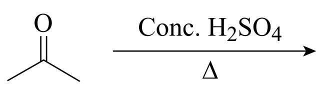
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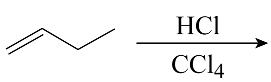
(d) 

51. Identify reactions that give aromatic products.

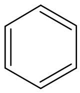
(a) 

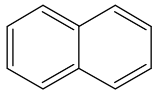
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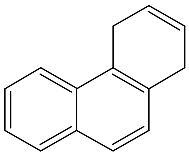
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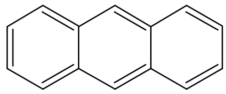
(d) 

52. Annealation takes place in which of the following compounds?

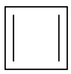
(a) 

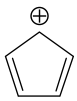
(b) 

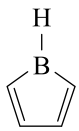
(c) 

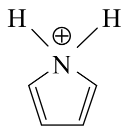
(d) 

53. Which of the following is an anti-aromatic compound?

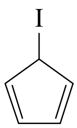
(a) 

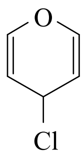
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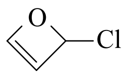
(c) 

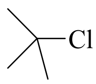
(d) 

54. Which compound does not give SN′/solvolysis reaction?

(a) 

(b) 

(c) 

(d) 

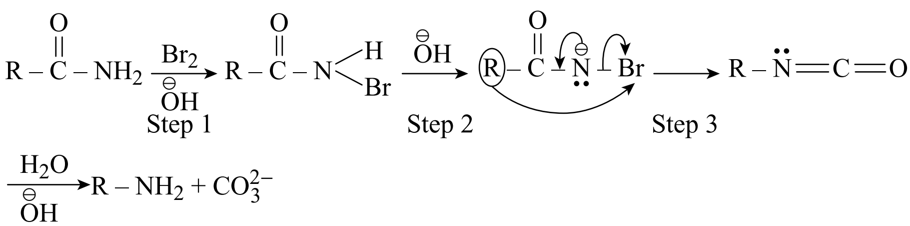
Comprehension Type

Passage 1

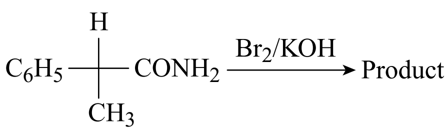
The conversion of an amide into an amine with one carbon atom less by the action of alkaline hydrohalite is known as Hofmann bromamide rearrangement:

$$RCONH_2 \xrightarrow{Br_2/KOH} R\text{—}NH_2$$

The most important feature of the reaction is the rearrangement of N–bromamide anion to isocyanate:



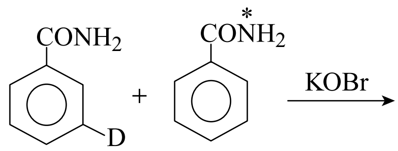
55. The product of the reaction

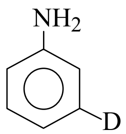
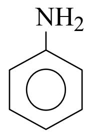
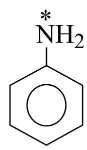
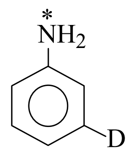


Product amine will be

(a) S-amine
(b) R-amine
(c) 50:50 mixture of (+) and (–) amine
(d) 30:70 mixture of (+) and (–) amine

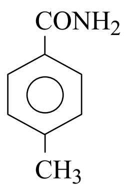
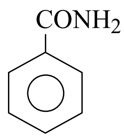
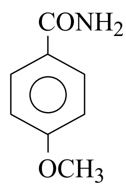
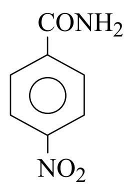
56. Predit the product in the following reaction



(i)  (ii)  (iii)  (iv) 

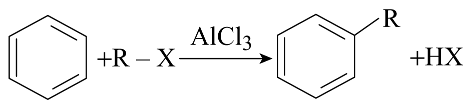
(a) i and ii (b) i and iii (c) ii and iii (d) i and iv

57. Which of the following can undergo Hofmann bromamide reaction most easily?

(a)  (b)  (c)  (d) 

Passage 2

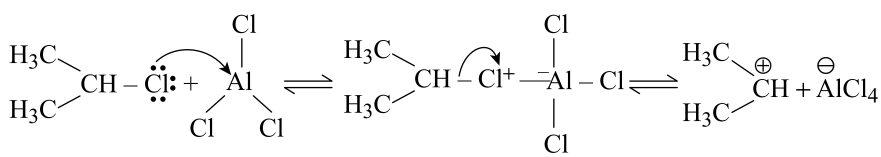
A general equation for a Friedel-Crafts alkylation reaction is the following



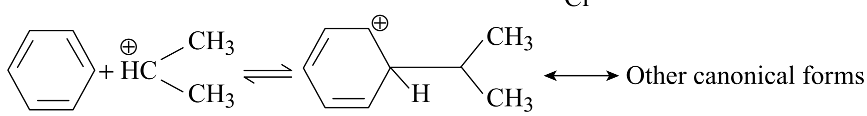
Alkyl halides by themselves are insufficiently electrophilic to react with benzene. Further, $AlCl_3$ serves as a Lewis acid catalyst to enhance the electrophilicity of the alkylating agent. The mechanism for the reaction is shown in the following steps

Mechanism for the reaction:

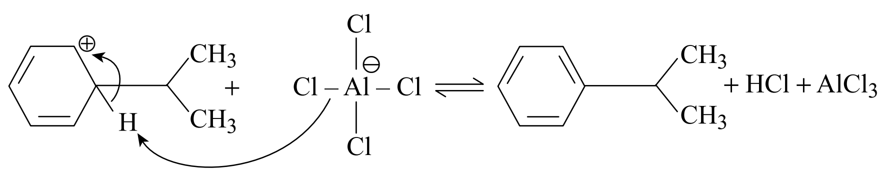
Step I



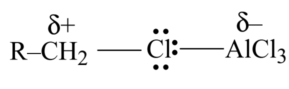
Step II



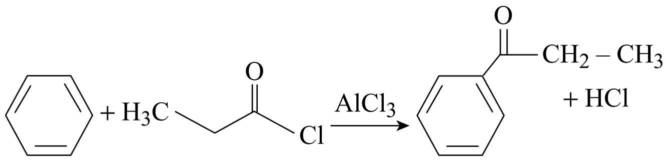
Step III



With R–X is a primary halide, the carbon halogen bond is nearly broken and one in which the carbon atom has a considerable +ve charge.



this complex acts as the electrophile. The Friedel-Crafts acylation reaction is an effective means of introducing an acyl group into an aromatic ring. The reaction is often carried out by treating the aromatic compound with an acyl halide.

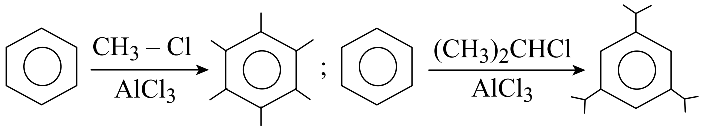


58. Consider the following statements for the given reaction

(i) The Friedel-Crafts reaction is an electrophilic aromatic substitution.
(ii) First step of the reaction is the rate-determining step.
(iii) Second step of the reaction is the rate-determining step.
(iv) Third step is an acid–base reaction.

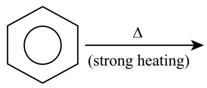
Now, of these statements

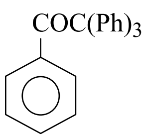
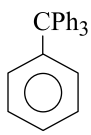
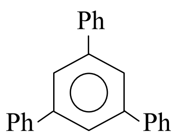
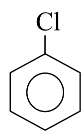
(a) i and ii are correct
(b) i, ii and iii are correct
(c) i, iii and iv are correct
(d) i, ii, iii and iv are correct

59. 

What is the reason for trisubstituted product in the second case?

(a) less positive inductive effect
(b) more steric effect
(c) less hyperconjugation
(d) more mesomeric effect

60. $Ph_3C\ COCl + AlCl_3 +$  The major product is

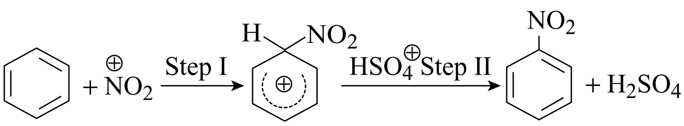
(a) 
(b) 
(c) 
(d) 

Passage 3

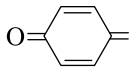
Nitration of benzene or any aromatic system is done by treating it with a mixture of Conc. HNO_3 and Conc. H_2SO_4 (called nitrating mixture). These two acids react together according to the equation given below, to form nitronium ion which act as an electrophile:

$$2H_2SO_4 + HNO_3 \longrightarrow 2HSO_4^- + H_3\overset{\oplus}{O} + \overset{\oplus}{N}O_2$$

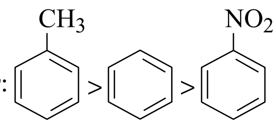
$\overset{\oplus}{N}O_2$ ion, an electrophile then attacks benzene or any aromatic system to accomplish nitration in the following two steps with arenium ion as the reaction intermediate:



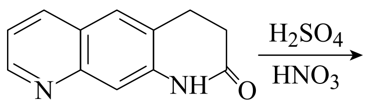
The direct nitration of aniline or phenol with nitrating mixture gives very poor yield of nitro product because benzene ring attached to $-NH_2$ or –OH group is very sensitive to oxidation and major part of aniline or phenol is oxidized to give a black tar mass that contains mainly

benzoquinone, . Although $-NH_2$ group is o/p-orienting, m-nitro derivative is also formed. The ring is protected from oxidation by acetylating $-NH_2$ group before subjecting it to nitration. After nitration, product is hydrolyzed to get deacetylated product (o- and p-nitro derivatives). Nitration of phenol is carried out by Dil. HNO_3. It is believed that nitrous acid (present as an impurity) interacts with HNO_3 to give nitrosonium ion, an electrophile which reacts with phenol to give o- and p-nitrosophenol, the latter being the principal product, according to the same mechanism as that of nitration mentioned above. Nitrosophenol is then oxidized by HNO_3 to nitrophenol while HNO_3 is itself reduced to HNO_2.

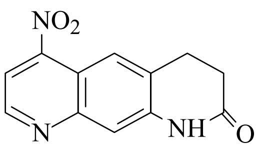
61. Regarding the nitration of phenol with Dil. HNO_3 as described above, the incorrect statement is
(a) HNO_3 acts as an acid and also as an oxidant.
(b) Nitrous acid acts as a base.
(c) The reaction intermediate is an arenium ion.
(d) Amount of HNO_2 goes on decreasing with the progress of nitration.

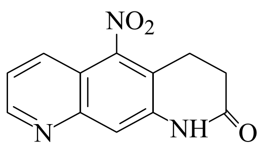
62. Correct statement is/are
(a) Rate of nitration is in the order: 

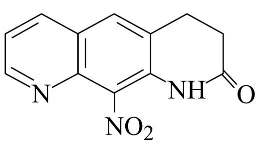
(b) Rate of nitration of benzene and that of hexa deuterated benzene occur almost at the same rate
(c) By increasing the concentration of acids ($HNO_3 + H_2SO_4$), the rate of nitration increases
(d) All of the above

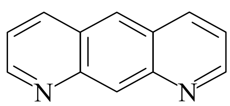
63. 

Major product is:

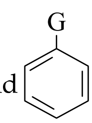
(a) 

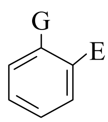
(b) 

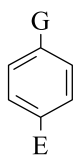
(c) 

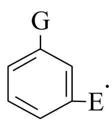
(d) 

Passage 4

It is very well known that when a compound 

reacts with an electrophile then we either get ortho- or para-substituted product, i.e., 

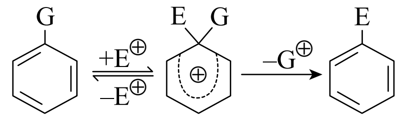
+ 

or we get a meta-substituted product, i.e., 

.

This depends on the electron-releasing or electron-withdrawing power of the group, i.e., +R/–R or +M/–M effect of group G. There is another theory that is the electrophile attacks the ring carbon where the substituent G is a already attached.

i.e.,

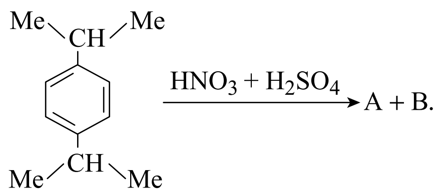


This is called ipso substitution reaction.

64. The factor which is expected to promote ipso substitution is

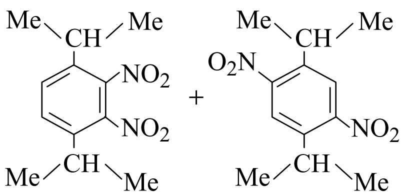
(a) The group G should be a strong electron withdrawing group
(b) A group which is highly electron withdrawing should be attached at ortho or para position with respect to the group G
(c) The group G should leave as G^+ easily, i.e., G^+ should be highly stable
(d) The group G should leave easily, i.e., G^+ should be highly unstable

65. In the reaction

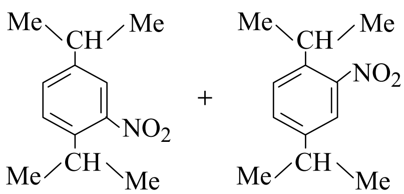


A and B are respectively

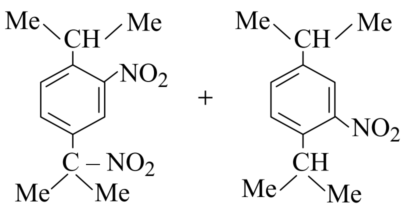
(a)



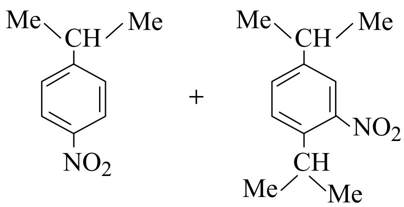
(b)



(c)

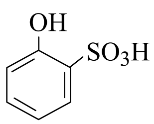


(d)

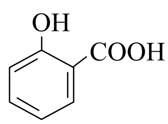


66. In which of the following can you expect ipso addition?

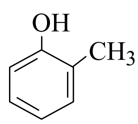
(i)



(ii)



(iii)



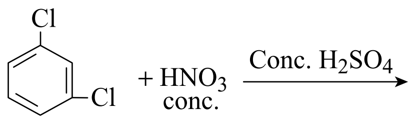
(a) i only (b) ii only (c) i and ii only (d) i, ii, and iii

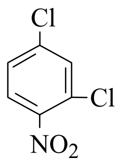
Passage 5

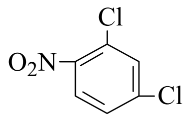
When a second substituent is introduced in benzene ring, it is directed by group already present on benzene ring. Electron-releasing groups are activating, therefore o and p-directing, whereas electron-withdrawing groups are deactivating, therefore m-directing. Halogens, although they are electron withdrawing due to –I effect but still o- and p-directing due to +R effect. –N=O

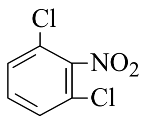
group is also deactivating but o- and p-directing due to presence of long pair of electrons like halogens it shows +R effect. When a third substituent is introduced into a disubstituted product, the o-isomer gives two, the m-isomer gives three while p-isomer gives only one product. This method is called Korner's method. The major product is formed such that it has minimum steric hindrance.

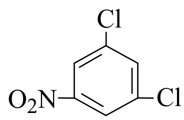
67. Which of the following is not formed at all?

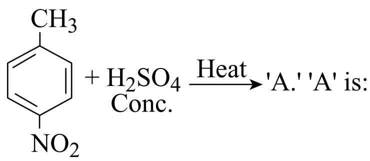


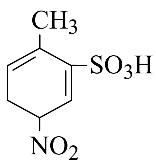
(a) 

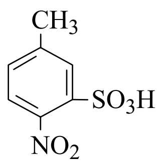
(b) 

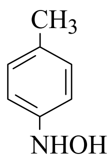
(c) 

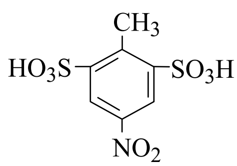
(d) 

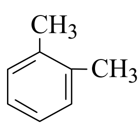
68. 

(a) 

(b) 

(c) 

(d) 

69.  (o-xylene) on mononitration gives

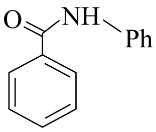
(a) two products (b) three products (c) one product (d) four products

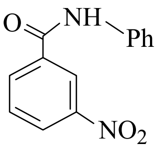
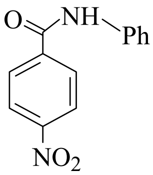
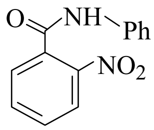
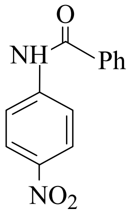
Passage 6

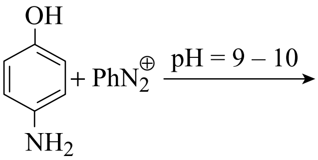
When a mono substituted benzene derivative, C_6H_5Y, undergoes further electrophilic substitution, e.g., nitration, the incoming substituent may be incorporated at the o-, m- or p- position and the overall rate at which substitution takes place may be faster or slower than with benzene itself. It has been observed that substitution occurs so as to yield either predominantly the m-isomer or a mixture of o- and p-isomers, in the former case the overall rate of attack is always

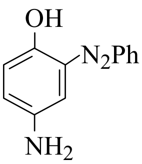
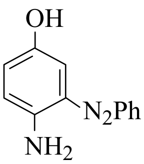
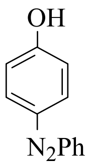
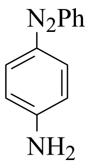
slower than on benzene itself, in the latter case the overall rate of attack is usually faster than on benzene itself. This is due to electronic effects that Y can exert.

Substituent, Y is thus classified as m- or o-/p-directing; if the substituent induces faster overall attack than on benzene itself then the substituent is said to be activating, if slower then deactivating.

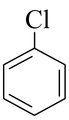
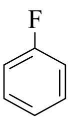
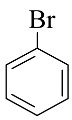
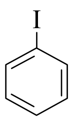
70.  on mononitration gives the major product

(a)  (b)  (c)  (d) 

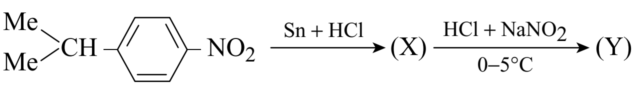
71.  X (major product). X will be

(a)  (b)  (c)  (d) 

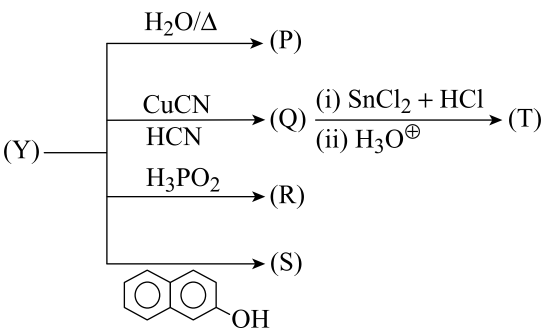
72. Which among the following will give highest yield of p-isomer during nitration?

(a)  (b)  (c)  (d) 

Passage 7

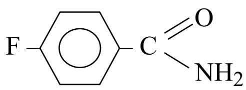


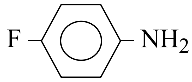
p-nitro cummene

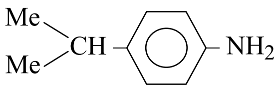


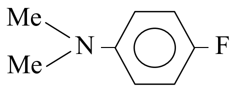
For the given reaction sequence, answer the following

73. (Y) $\xrightarrow[\Delta]{HBF_4}$ $\xrightarrow[\Delta]{KMnO_4/H^{\oplus}}$ $\xrightarrow[H_2SO_4]{N_3H}$ Final product; final product is

(a) 

(b) 

(c) 

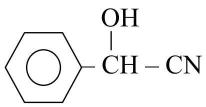
(d) 

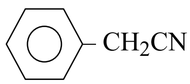
74. (R) $\xrightarrow[\text{(ii) NaOH + I}_2]{\text{(i) CH}_3\text{COCl/AlCl}_3}$ (A) + (B)↓ Yellow ppt.

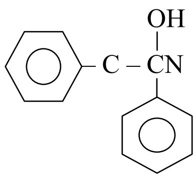
(A) $\xrightarrow[\text{(ii) SOCl}_2]{\text{(i) H}_2\text{O/H}^{\oplus}}$ Product (L)
(iii) (R)/$AlCl_3$
(iv) $H^{\oplus}$, Δ

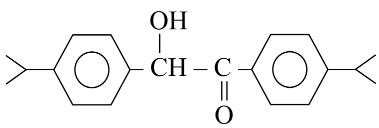
The correct statement about the product (L) is
(a) Product (L) on reaction with Tollen's reagent gives silver mirror
(b) Product (L) on reaction with $H_2N–NH_2/^{-}OH$, Δ gives diphenyl methane
(c) Product (L) on reaction with HCN gives a compound which contains a chiral centre
(d) All of these

75. Compound (T) $\xrightarrow[KCN]{Alc.}$ Product is

(a) 

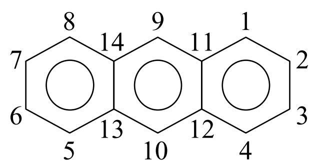
(b) 

(c) 

(d) 

Passage 8

Consider the aromatic anthracene molecule, $C_{14}H_{10}$, shown in the figure:



Approximate calculation of the π-bond order for C–C bonds yield the following results

Bond	π-bond order
1–2	0.738
1–11	0.535
2–3	0.586
9–11	0.606
11–12	0.485

Also, considering the electron displacement effect in combination with bond order data, answer the following questions.

76. Which of the following carbon is most likely to be attacked by an electrophile (NO_2^+ in acetic anhydride at 15–20°C)?

(a) C–1 (b) C–9
(c) C–2 (d) C–11

77. Which of the following C–C bond has least percentage of single bond character?

(a) C_1–C_2 (b) C_1–C_{11}
(c) C_{11}–C_{12} (d) C_2–C_3

78. Which of the following (C–C) bonds are shortest and longest respectively?

(a) 11–12 and 1–2 (b) 1–2 and 11–12
(c) 9–11 and 1–2 (d) 2–3 and 9–11

Passage 9

Benzene gives electrophilic substitution reaction with strong electrophilic. The leaving group of this reaction is H in the form of $H^{\oplus}$, –COOH in the form of CO_2 and $–SO_3H$ in the form of SO_2. The reaction is known as aromatic electrophilic substitution (ArSE) reaction.

79. Benzene can be obtained by

(a) Conc. HNO_3/Conc. H_2SO_4/Benzene
(b) NO_2BF_4/Benzene
(c) NO_2ClO_4/Benzene
(d) Phenol/Zn

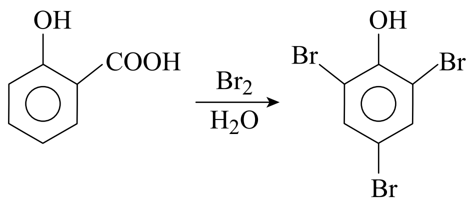
80. Consider the following statements

(i) Benzene reacts with electrophile to form reaction intermediate known as cyclohexadienyl cation.
(ii) Formation of carbon-electrophilic bond is rate-determining step in ArSE reaction.
(iii) Breaking of C – H bond is rate-determining step
(iv) Sulphonation of benzene is a reversible reaction

The correct statements from the above are

(a) i, ii, iii and iv (b) i, ii and iv
(c) i, iii and iv (d) ii, iii and iv

81. In the given reaction

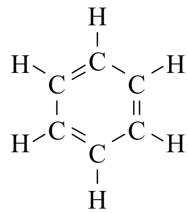


The leaving group(s) in the form of electrolphile is

(a) $2H^{\oplus}$ only (b) One $H^{\oplus}$ and one CO_2
(c) $2H^{\oplus}$ and one CO_2 (d) One CO_2 only

Passage 10

Based on the Lewis structure of benzene



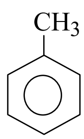
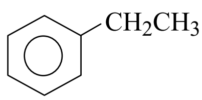
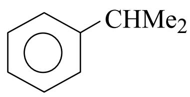
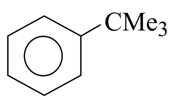
Benzene

82. What is the bond angle for each H-C-C and each C-C-C on benzene?
(a) 120° and 120° (b) 109.5° and 120° (c) 120° and 109.5°
(d) 180° and 120° (e) None of these

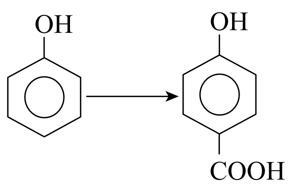
83. What one of the following is the best description for the overall shape of benzene molecule?
(a) Linear (b) Triangular (c) Tetrahedron
(d) Planar (e) Goofy

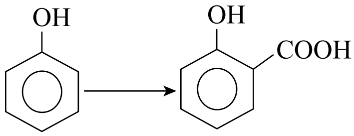
Matrix Type

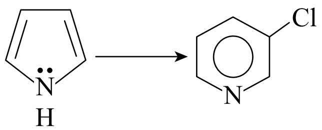
84. Match the columns.

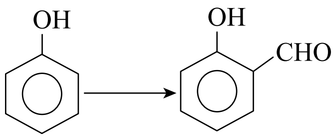
Column I (alkene)	Column II (o/p ratio in nitration)
(a) 	(p) 0.22
(b) 	(q) 0.92
(c) 	(r) 1.57
(d) 	(s) 0.48

85. Match the columns.

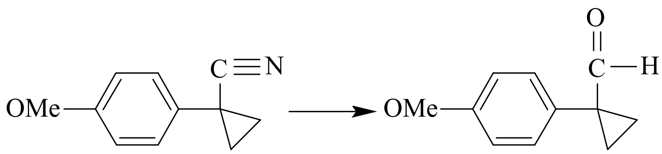
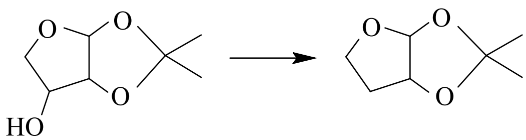
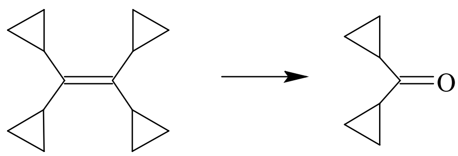
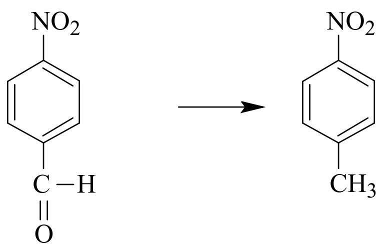
Column I	Column II (reagents used for the desired product in major amount)
(a) 	(p) $CHCl_3$/NaOH

(b)  (q) CCl_4/NaOH

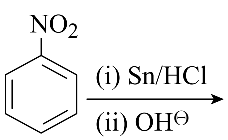
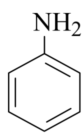
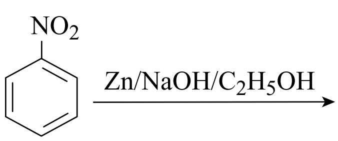
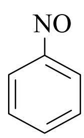
(c)  (r) NaOH followed by CO_2

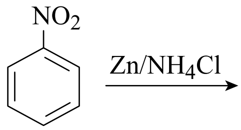
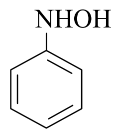
(d)  (s) KOH followed by CO_2

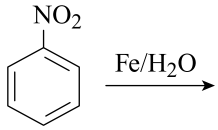
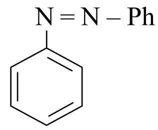
86. Identify reaction correct match with its reagent

Reaction	**Reagent**
(a) 	(p) DIBAL–H/H_3O^+
(b) 	(q) T_SCl/LAH
(c) 	(r) O_3/Zn
(d) 	(s) Zn–Hg/HCl

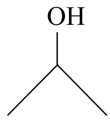
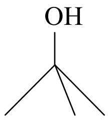
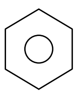
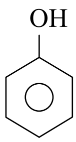
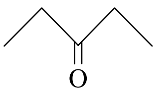
87. Match the reduction in **Column I** with their products listed in **Column II**.

Column I	**Column II**
(a) 	(p) 
(b) 	(q) 

(c)  (r) 

(d)  (s) 

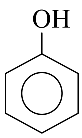
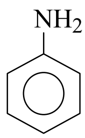
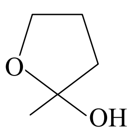
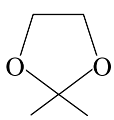
88. Match the processes in **Column I** with properties in **Column II**.

Column I (pair of compounds)	**Column II** (reagent used to distinguish pair of compounds)
(a)  and 	(p) Br_2/H_2O test
(b)  and 	(q) Tollen's reagent
(c) $\mathrm{Me-\overset{O}{\overset{\Vert}{C}}-H}$ and 	(r) Iodoform test
(d) $Me-CH_2-C\equiv CH$ and $Me-C\equiv C-Me$	(s) Lucas reagent
	(t) Ammonical cuprous chloride

89. Match the **Column I** with **Column II**.

Column I	**Column II**
(a) Toluene	(p) On oxidation by $KMnO_4$ in acid medium gives benzoic acid
(b) Cumene	(q) Used in the manufacture of phenol
(c) Benzene	(r) Symmetrical trimethyl benzene
(d) Mesitylene	(s) On oxidation (V_2O_5/O_2) at 250–450°C gives maleic anhydride

90. Match the columns.

Column I (pair of compounds)	**Column II** (reagents used for identification)
(a)  and 	(p) $Br_2 + H_2O$ test
(b) $\mathrm{Et-\overset{O}{\overset{\Vert}{C}}-H}$ and $\mathrm{Me-\overset{O}{\overset{\Vert}{C}}-Me}$	(q) $CHCl_3 + NaOH$ test
(c) Me–C≡C–H and Me–C≡C–Me	(r) Iodoform test
(d)  and 	(s) Tollen's reagent

91. Match the columns.

Column I (reaction)	**Column II (reagents)**
(a) $R-\overset{O}{\overset{\|\|}{C}}-NH_2 \longrightarrow RNH_2$	(p) KOBr
(b) $R-\overset{O}{\overset{\|\|}{C}}-NH-R \longrightarrow RNH_2$	(q) OH^-/H_2O
(c) $R-\overset{O}{\overset{\|\|}{C}}-OH \longrightarrow RNH_2$	(r) $N_3H/H^{\oplus}$
(d) $R-\overset{O}{\overset{\|\|}{C}}-NH-NH_2 \longrightarrow RNH_2$	(s) $HNO_2/\Delta/H_3O^{\oplus}$

92. Match the columns.

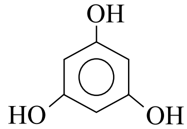
Column I (pair)	**Column II**
(a) $CH_3-\overset{O}{\overset{\|\|}{C}}-Cl/NaN_3$	(p) Lossen rearrangement
(b) $CH_3-\overset{O}{\overset{\|\|}{C}}-NH_2/NaOBr$	(q) Schmidt rearrangement
(c) CH_3COOH/N_3H	(r) Hofmann rearrangement
(d) $C_6H_5-\overset{O}{\overset{\|\|}{C}}-NH-O-\overset{O}{\overset{\|\|}{C}}-CH_3/Base$	(s) Curtius rearrangement

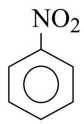
93. Match the **Column I** with **Column II**.

Column I	**Column II (Intermediate/Product)**
(a) $CH_3-\overset{O}{\overset{\|\|}{C}}-NH_2 \xrightarrow{KOH + Br_2}$	(p) $CH_3N{=}C{=}O$
(b) $CH_3-\overset{O}{\overset{\|\|}{C}}-OH \xrightarrow[H_2SO_4]{N_3H}$	(q) $CH_3-\overset{O}{\overset{\|\|}{C}}-NHBr$
(c) $CH_3-\overset{O}{\overset{\|\|}{C}}-OH \xrightarrow[\Delta]{NH_3}$	(r) $CH_3-\overset{O}{\overset{\|\|}{C}}-ONH_4$
(d) $CH_3-\overset{O}{\overset{\|\|}{C}}-Cl \xrightarrow[\text{(ii) } H_3O^{\oplus}]{\text{(i) } NaN_3}$	(s) CH_3NH_2

94. Match **Column I** with **Column II**.

Column I (elements/compounds)	**Column II (tests)**
(a) Halogens	(p) Br_2/H_2O
(b) $R-\overset{O}{\overset{\|\|}{C}}-CH_3$	(q) Baker-Mulliken test

(c)  (r) Iodoform test

(d)  (s) Beilstein test

95. Match **Column I** with **Column II**.

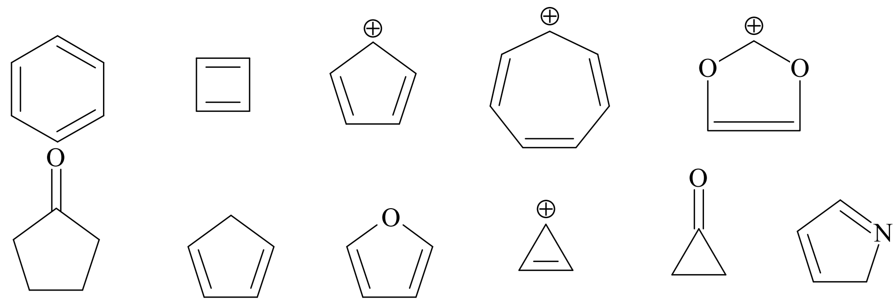
Column I [name of reaction]	**Column II [substrate(s) of reaction]**
(a) Haloform reaction	(p) α-methyl carbonyl compound
(b) Aldol addition	(q) Acid amide
(c) Witting reaction	(r) Aldehyde
(d) Hofmann bromamide reaction	(s) Halide and carbonyl

96.

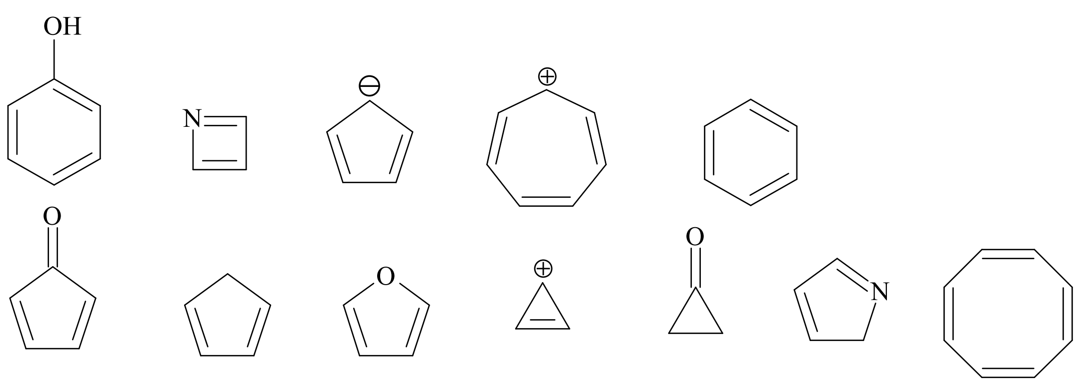
Column I (reaction)	**Column II (intermediate)**
(a) Wurtz reaction	(p) Carbocation
(b) Dehydration of alcohol with Conc. H_3PO_4	(q) Electrophile (excluding free radicals)
(c) Kolbe's electrolysis	(r) Free radical
(d) Diazotisation	(s) Carbanion
	(t) N_2 gas liberated in intermediate step

Integer Type

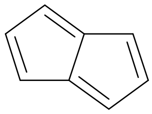
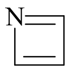
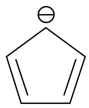
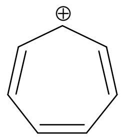
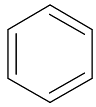
97. Identify compounds which are aromatic.

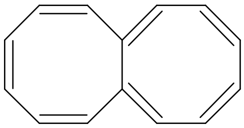
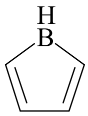
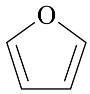
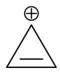
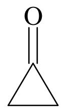
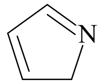
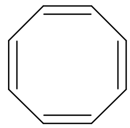


98. Identify compounds which are nonaromatic.

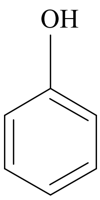
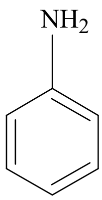
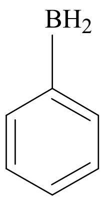
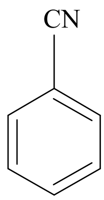
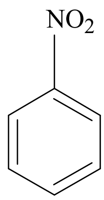
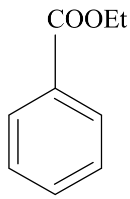


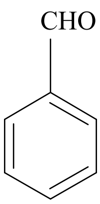
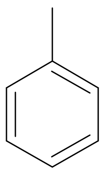
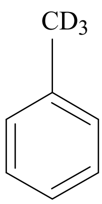
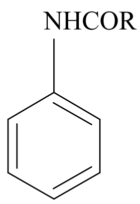
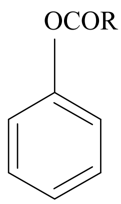
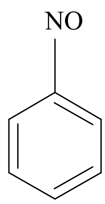
99. Identify compounds which are antiaromatic.

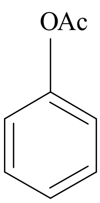
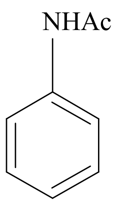
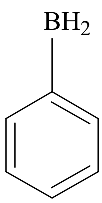
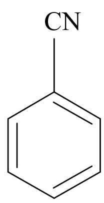
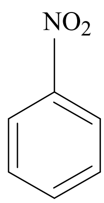
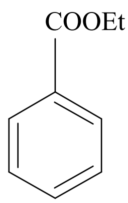
      

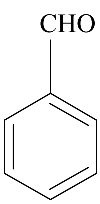
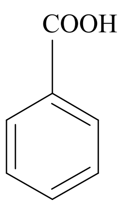
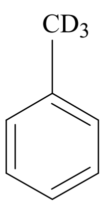
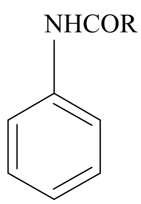
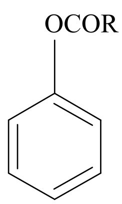
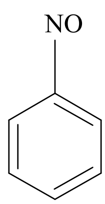
100. Identify compounds which react faster than benzene in ArSE reaction?

101. Identify compounds which react slower than benzene in ArSE reaction?

Answer Keys

LEVEL 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
b	b	c	c	c	b	a	a	c	b	c	c	c	c	b
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
b	a	b	c	d	d	d	d	b	d	b	c	b	cd	b
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
c	b	d	d	b	b	c	d	d	a	b	a	a	d	b
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
c	b	a	b	b	b	b	a	c	b	c	b	d	a	c
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
d	c	c	d	a	c	a	ac	c	b	a	c	d	d	a
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
b	a	c	c	d	b	b	c	a	b	b	a	b	b	b
91	92	93	94	95	96	97	98							
b	d	a	a	c	d	ab	c							

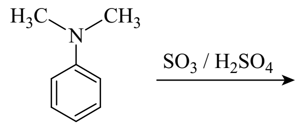
LEVEL 2

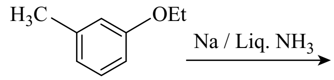
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
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d	a	a	c	c	c	b	b	a	b	a	a	a	d	b
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
d	abc	abc	bc	ab	bd	bc	bc	acd	acd	abcd	ab	abd	ac	abd
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
abcd	ab	abd	bd	ad	abc	bcd	abc	ac	a	b	c	c	b	b
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
b	d	c	c	d	c	d	d	a	d	a	d	b	b	d
76	77	78	79	80	81	82	83	84(a)	84(b)	84(c)	84(d)	85(a)	85(b)	85(c)
b	b	b	d	b	c	a	d	r	q	s	p	s	qr	p
85(d)	86(a)	86(b)	86(c)	86(d)	87(a)	87(b)	87(c)	87(d)	88(a)	88(b)	88(c)	88(d)	89(a)	89(b)
p	p	q	r	s	p	s	r	q	rs	pq	qr	qt	p	pq
89(c)	89(d)	90(a)	90(b)	90(c)	90(d)	91(a)	91(b)	91(c)	91(d)	92(a)	92(b)	92(c)	92(d)	93(a)
s	r	q	rs	s	r	p	q	r	s	s	r	q	p	pqs
93(b)	93(c)	93(d)	94(a)	94(b)	94(c)	94(d)	95(a)	95(b)	95(c)	95(d)	96(a)	96(b)	96(c)	96(d)
ps	r	ps	s	r	p	q	prs	pr	prs	q	rs	pq	r	pqt
97	98	99	100	101										
5	4	3	6	7										

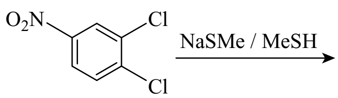
WORKBOOK EXERCISES

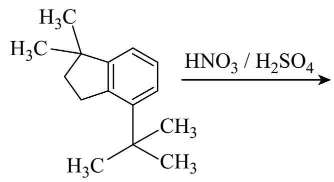
EXERCISE 1

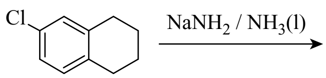
Identify complete reaction sequence

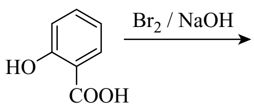
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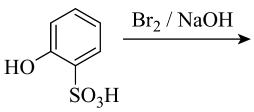
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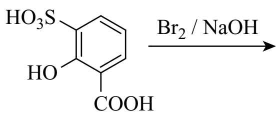
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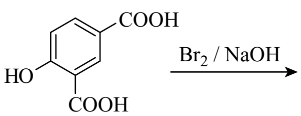
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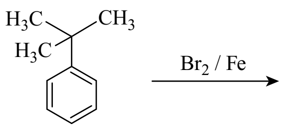
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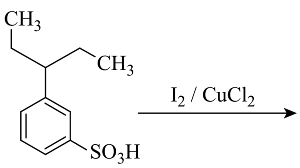
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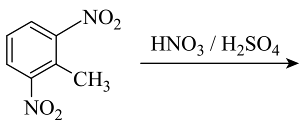
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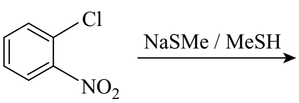
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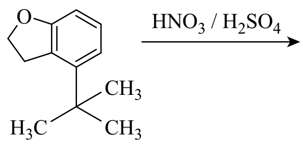
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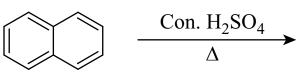
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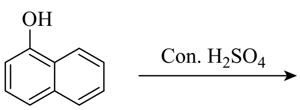
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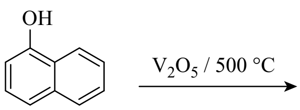
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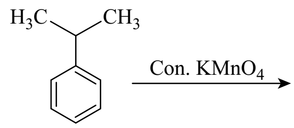
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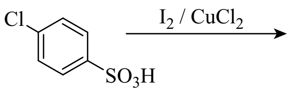
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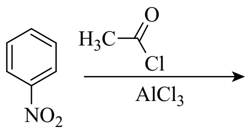
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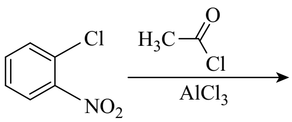
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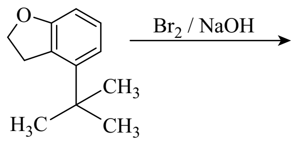
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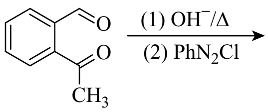
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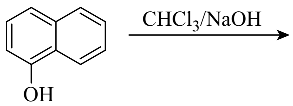
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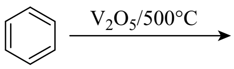
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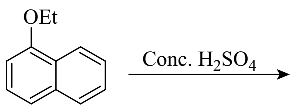
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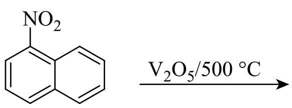
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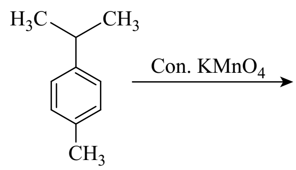
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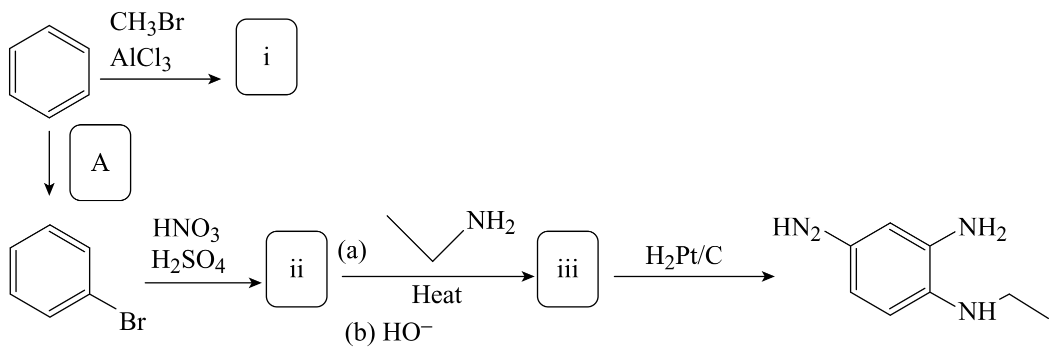
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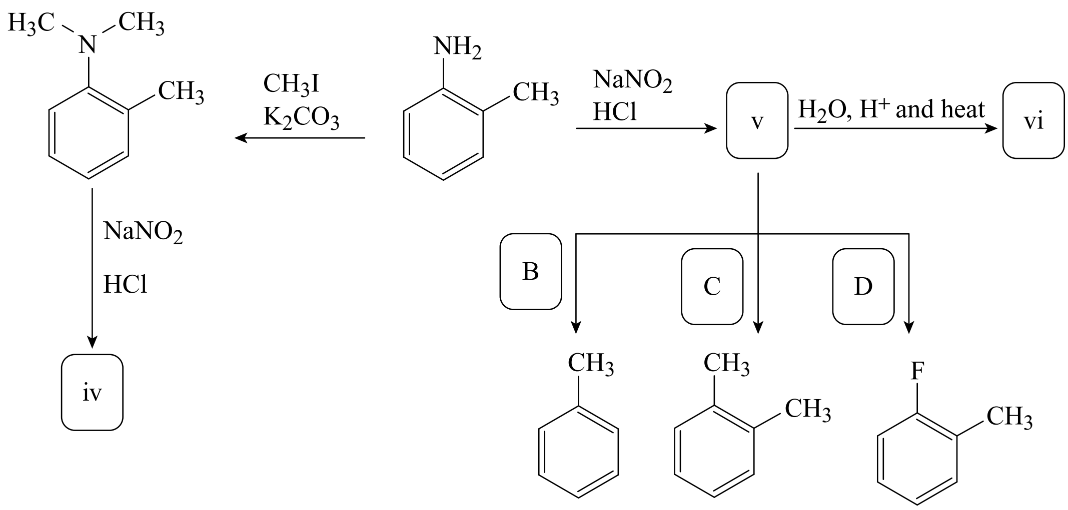
EXERCISE 2

Identify reagent used and intermediate products in the following conversion.

A. Multiple-step synthesis

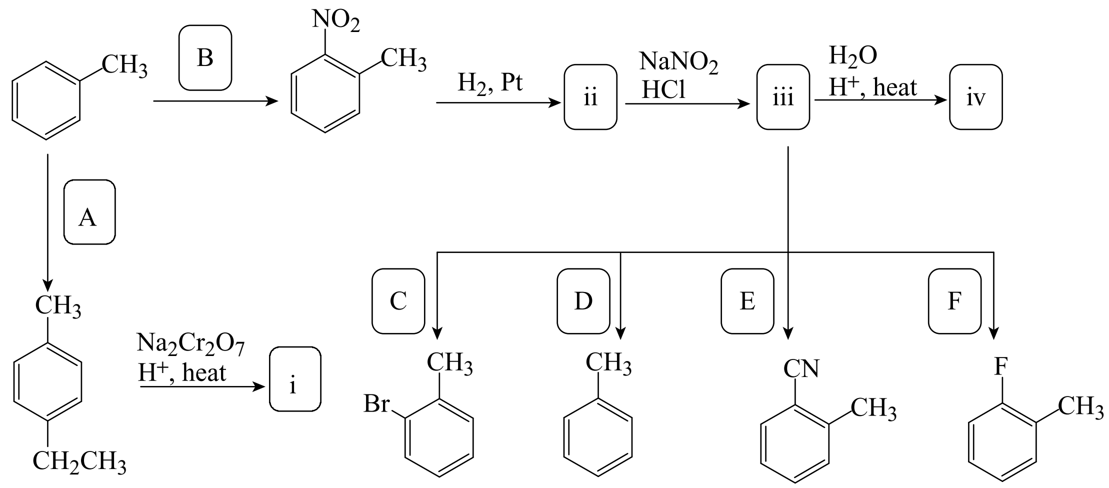


B. Multiple-step synthesis



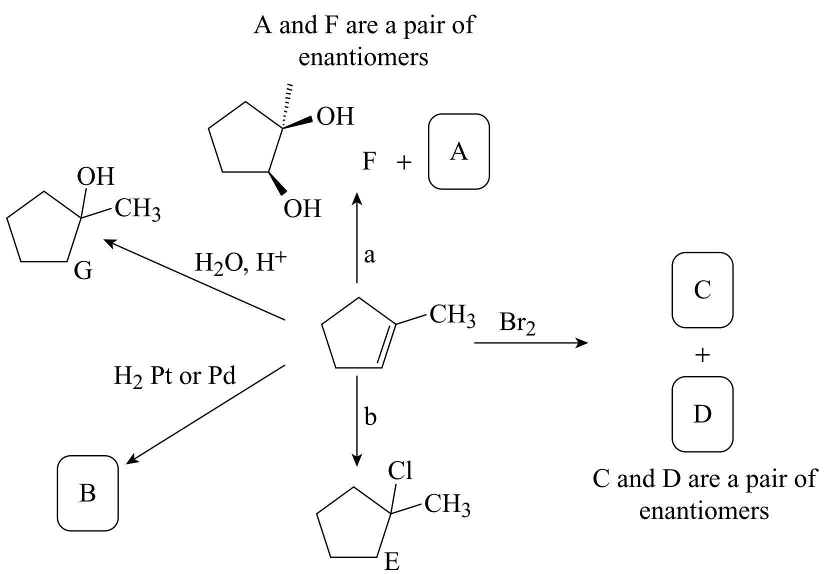
EXERCISE 3

Identify reagent used and intermediate products in the following conversion.



EXERCISE 4

Identify reagent used and intermediate products in the following conversion.

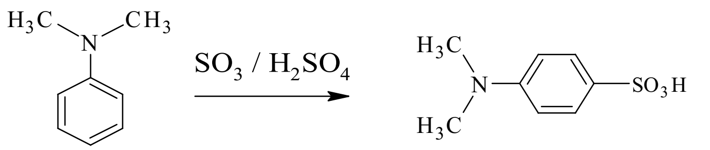


SOLUTION FOR WORKBOOK EXERCISES

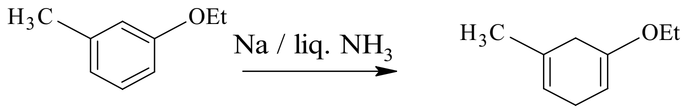
EXERCISE 1

Identify complete reaction sequence.

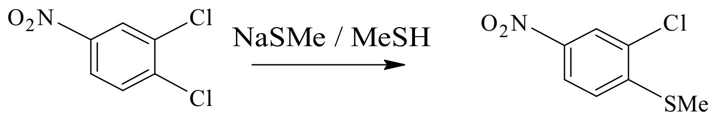
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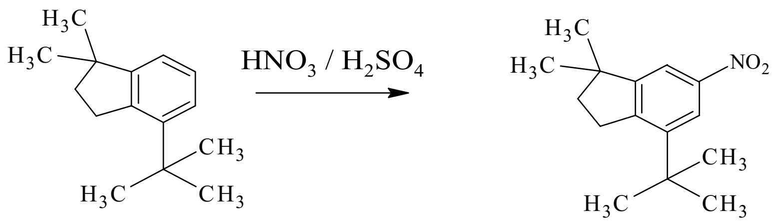
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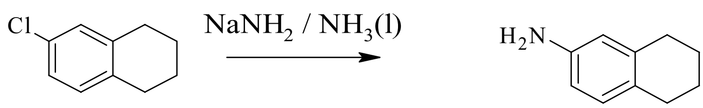
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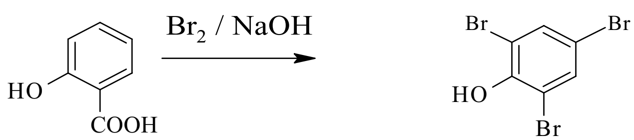
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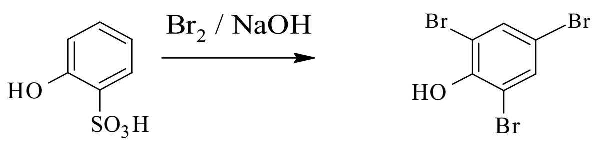
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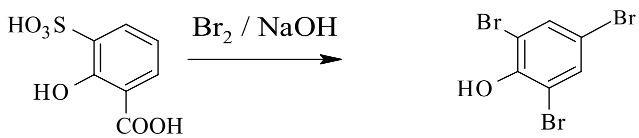
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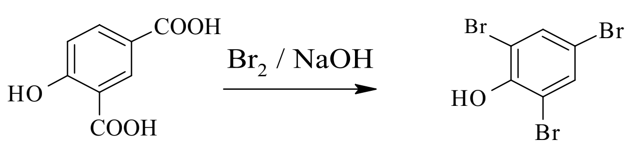
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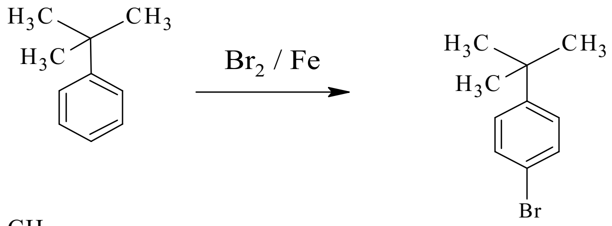
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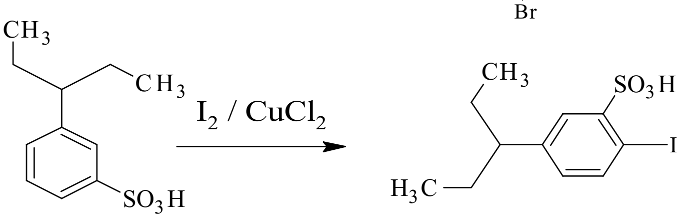
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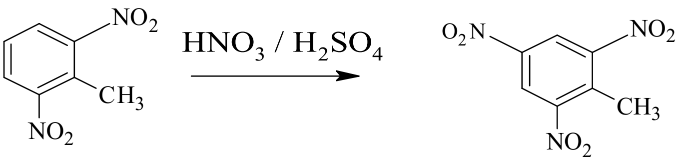
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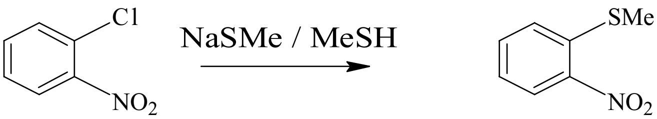
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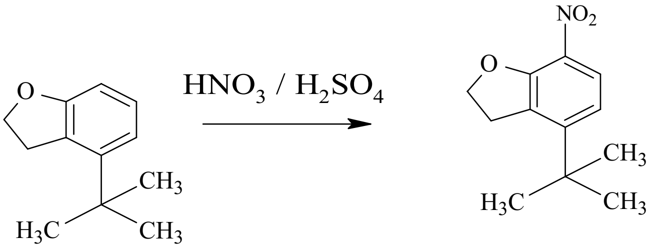
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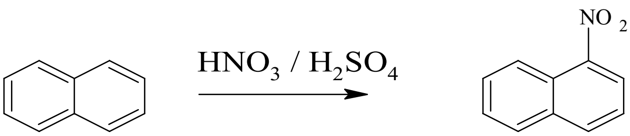
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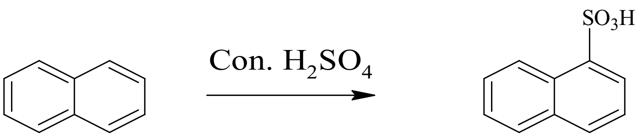
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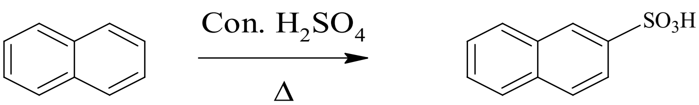
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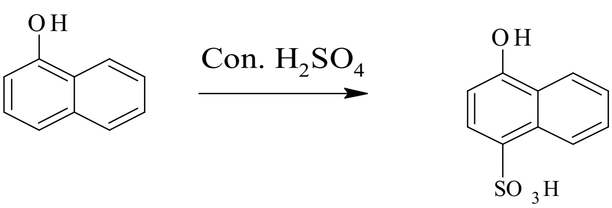
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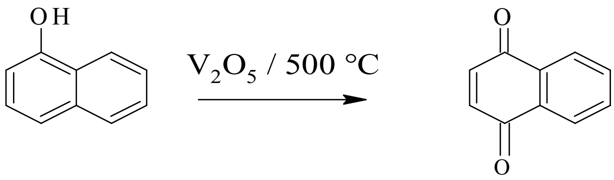


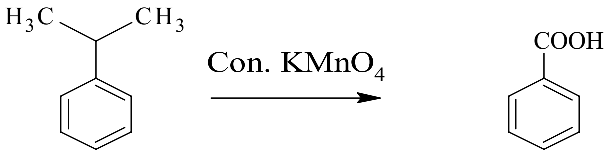
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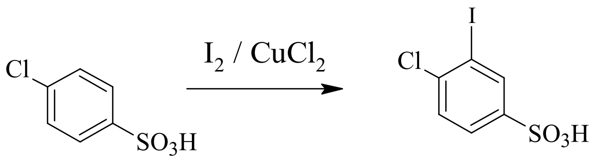


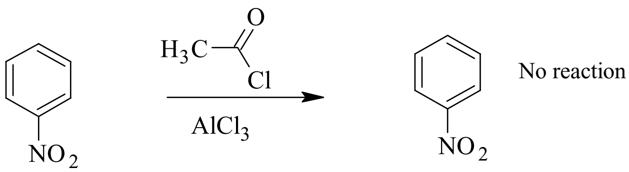
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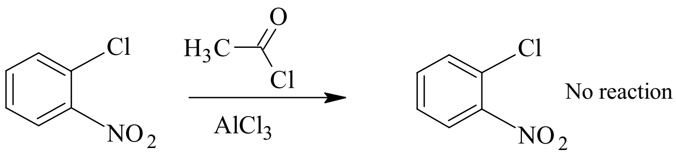


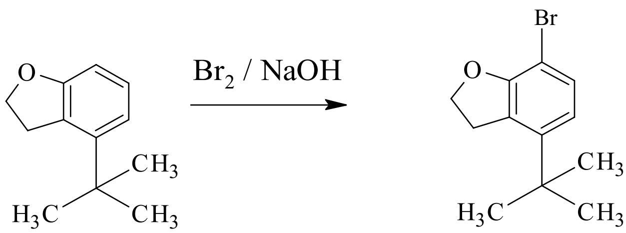
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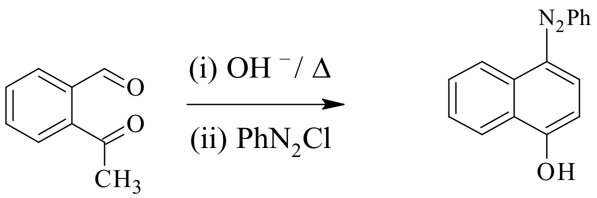
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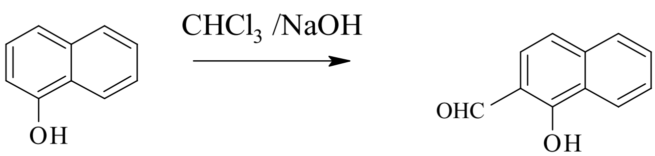
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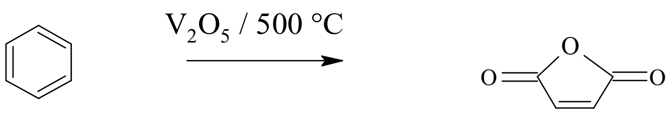
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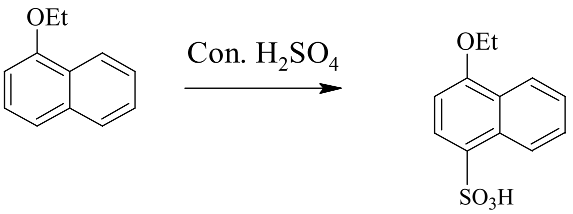
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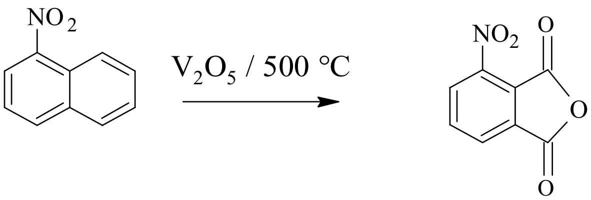
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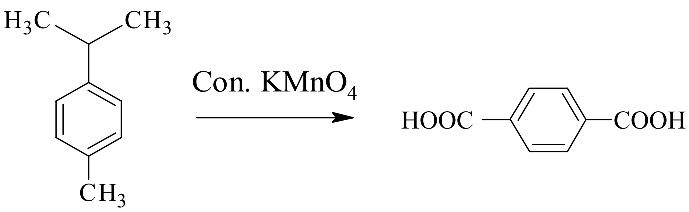
28.


OEt
Con. H_2SO_4
OEt
SO_3H

29.

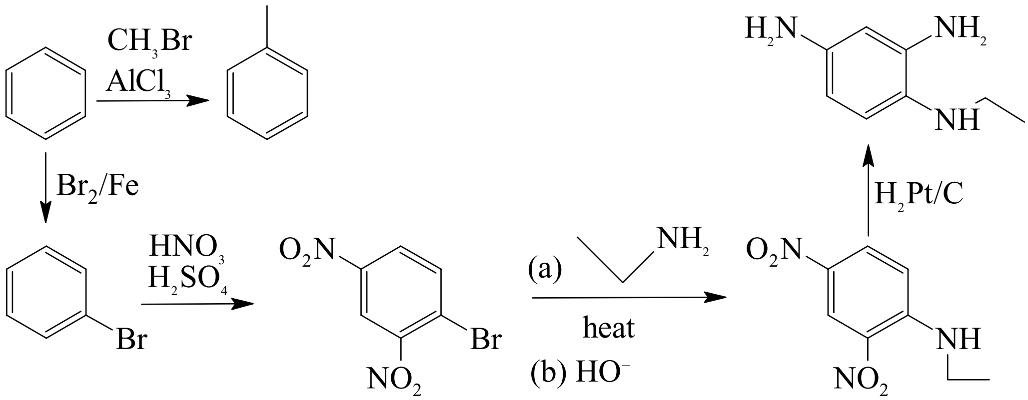

NO_2
V_2O_5 / 500 °C
NO_2
O
O
O

30.

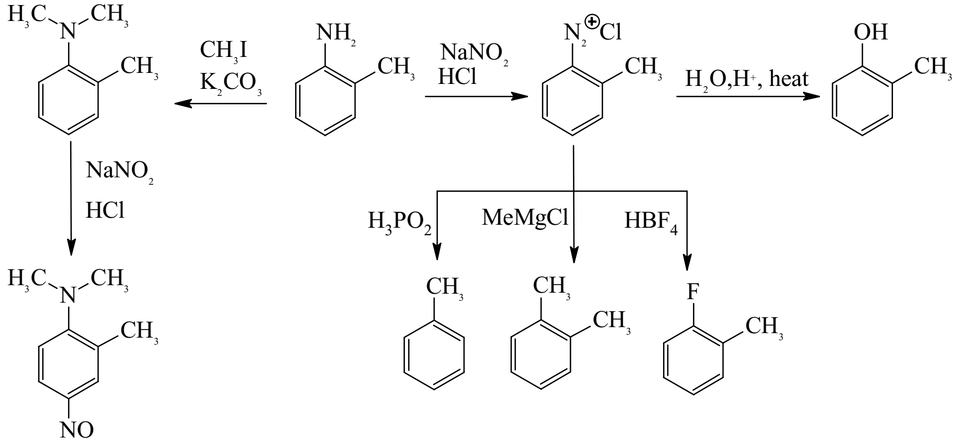

H_3C
CH_3
CH_3
Con. $KMnO_4$
HOOC
COOH

EXERCISE 2

A. Multiple-step Synthesis

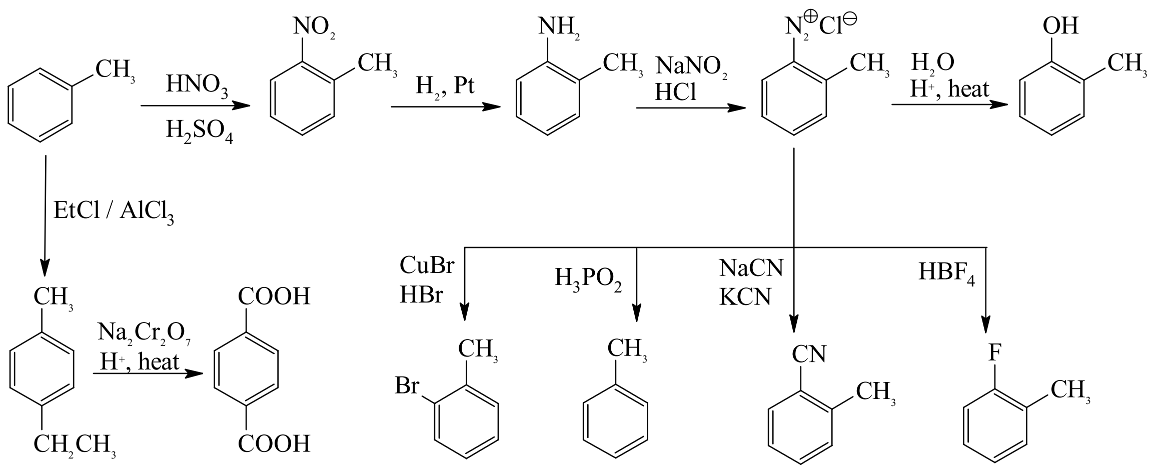


B. Multiple-step Synthesis



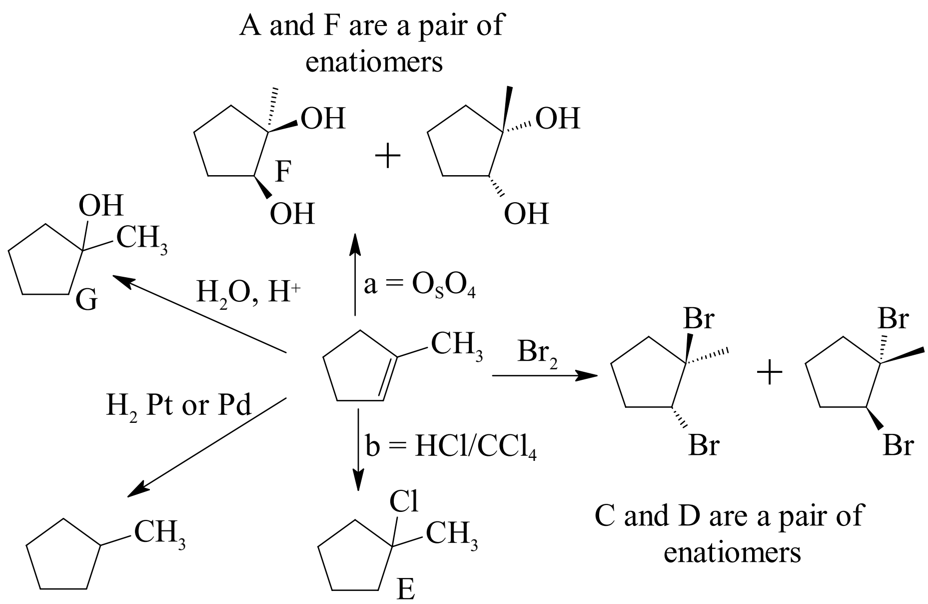
EXERCISE 3

Identify reagent used and intermediate products in following conversion.

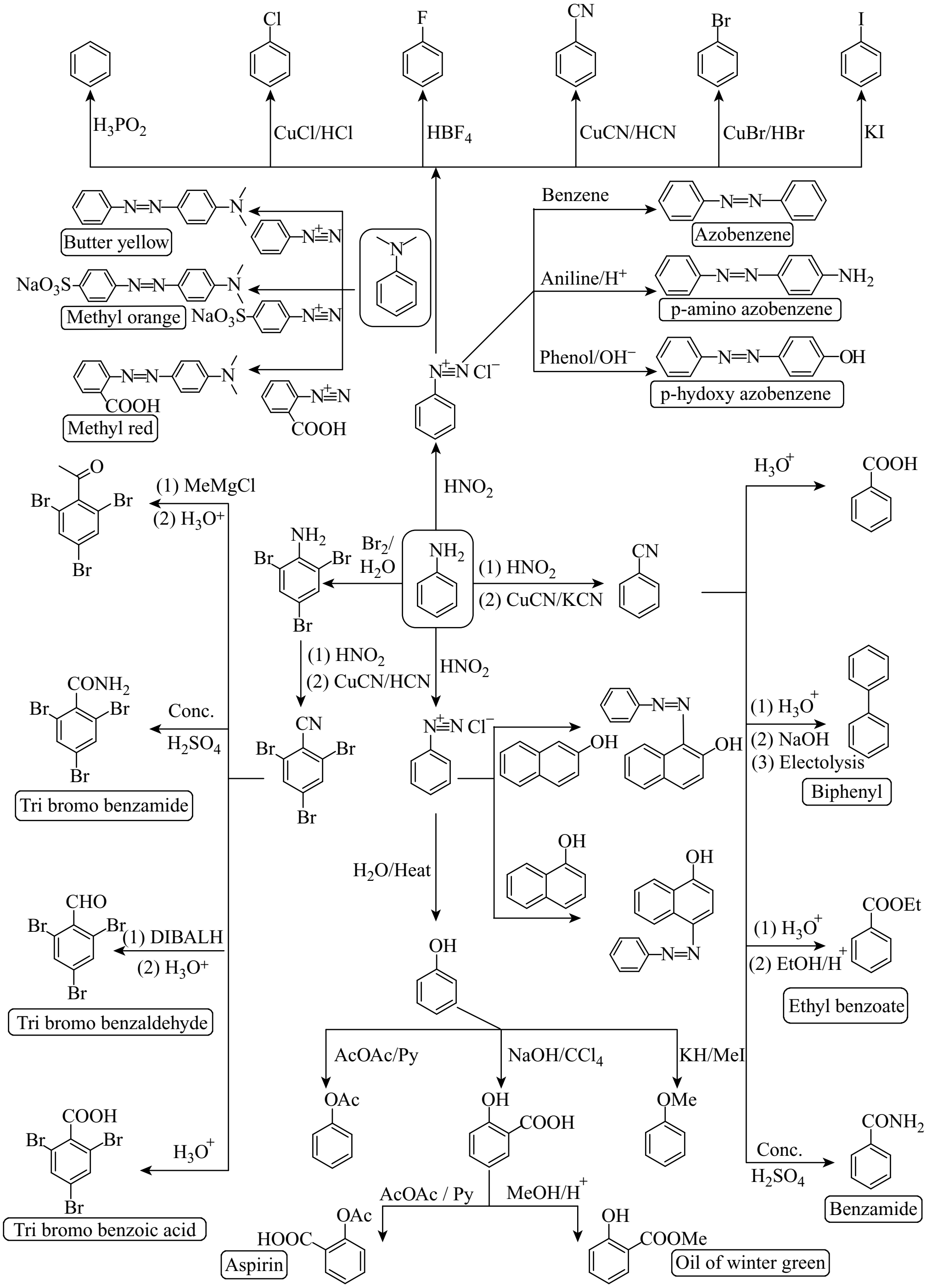


EXERCISE 4

Identify reagent used and intermediate products in following conversion.



Reaction Mechanism Chart



CHAPTER 7

Biomolecules

Question Bank

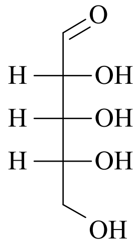
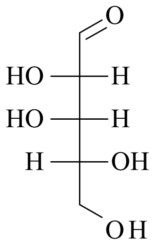
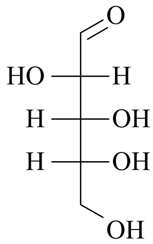
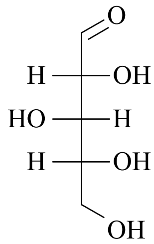
LEVEL 1

1. Which of the following statements is correct?
(a) The Ruff procedure lengthens an aldose chain and gives a single product.
(b)
(c) The Kiliani-Fischer procedure shortens an aldose chain and gives a single product.
(d) The Kiliani-Fischer procedure lengthens an aldose chain and gives two epimers.

2. Which of the following is not a disaccharide?
(a) sucrose (b) mannose (c) lactose (d) maltose

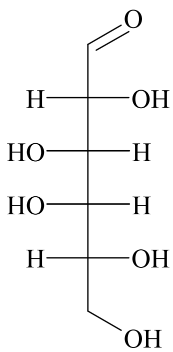
3. Which statement about the pyranose form of mannose is not correct?
(a) it exists as two anomeric stereoisomers.
(b) it reacts with Tollen's reagent to give a silver mirror (i.e., it is a reducing sugars).
(c) reaction with excess CH_3I and AgOH gives a non-reducing penta-O-methyl derivative.
(d) it resists reduction with aqueous sodium borohydride.

4. Two aldopentoses X and Y give the same osazone derivative. X is oxidised to an optically active aldaric acid by dilute nitric acid. Ruff degradation of Y gave a tetrose which was similarly oxidised to an optically active aldaric acid. Assign the structures of X and Y from the following list.

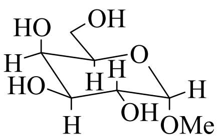
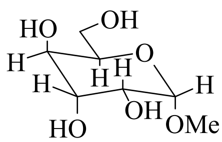
(i)  (ii)  (iii)  (iv) 

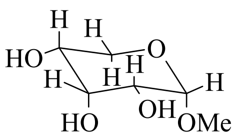
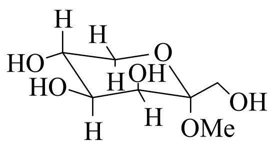
(a) X = i and Y = iii
(b) X = iv and Y = ii
(c) X = v and Y = iv
(d) X = iii and Y = i

5. Which of the structures 1 through 4 is methyl-D-galactopyranoside?



D-Galactose

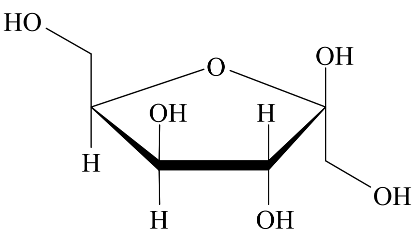
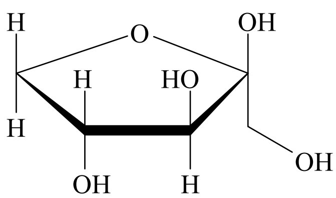
(i)  (ii) 

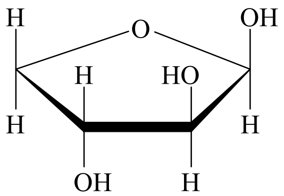
(iii)  (iv) 

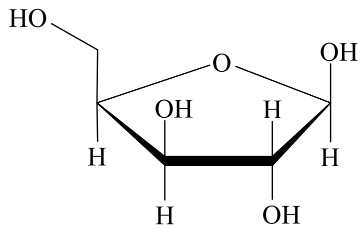
(a) i (b) ii (c) iii (d) iv

6. What is invert sugar, and why is it so named?
(a) the sugar mixture from hydrolysis of sucrose; fructose is isomerised to glucose.
(b) the sugar mixture from hydrolysis of sucrose; the optical rotation changes from (+) to (–).
(c) the sugar mixture from hydrolysis of starch; α-glycosidic bonds are changed to β-glycosidic bonds.
(d) the sugar mixture from hydrolysis of starch; glucose is isomerised to fructose.

7. Which of the following compounds is a β-aldopentafuranose?

(i)  (ii) 

(iii) 

(iv) 

(a) i (b) ii (c) iii (d) iv

8. When octa-O-methyl D-cellobiose is hydrolysed by an aqueous acid, two O-methyated glucose derivatives are formed. One is a tetramethyl derivative, and the other is a trimethyl derivative. Why is a single methyl substituent lost in this process?

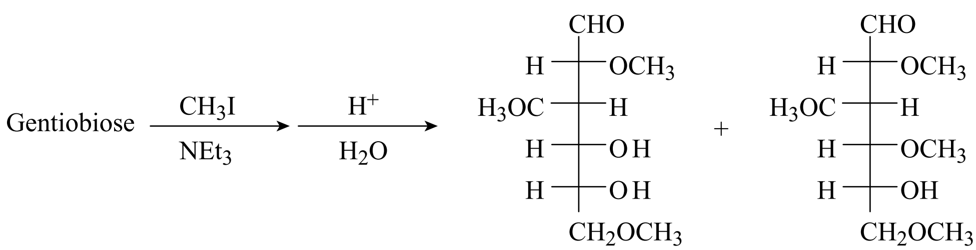
(a) one methoxy group is lost by β-elimination.
(b) one methoxy group is an ester and the others are all ethers.
(c) one methoxy group is part of an acetal, the others are all ethers.
(d) one glucose is an α-methyl glycoside; the other is a β-methyl glycoside.

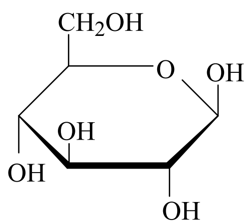
9. Acid-catalysed reaction of D-glucose with benzaldehyde produces the 4,6-O-benzylidene derivative. Reduction with NaBH4, followed by excess HIO4 cleavage and acid hydrolysis yields a $C_4H_8O_4$ tetrose and benzaldehyde. What is the configuration of this tetrose?

(a) 2S, 3S (b) 2R, 3S (c) 2R, 3R (d) 2S, 3R

10. Gentiobiose is a disaccharide incorporated into the chemical structure of crocin, the chemical compound that gives saffron its colour. Deduce the structure of gentiobiose from the following information.

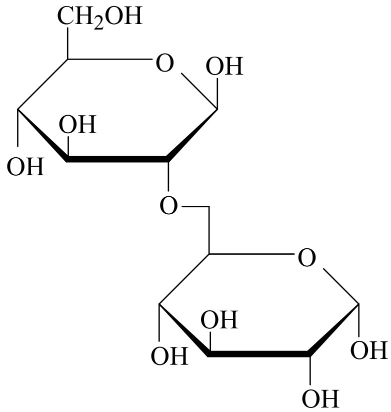
(i) Acid hydrolysis of gentiobiose yields only D-glucose.
(ii) Gentiobiose is hydrolysed by β-glucosidase enzymes, but not by α-glucosidase enzymes.
(iii) Gentiobiose is a reducing sugar and reacts with sodium borohydride.
(iv) Methylation of gentiobiose followed by hydrolysis of the glycosidic bonds yields the two D-glucose derivatives shown below.

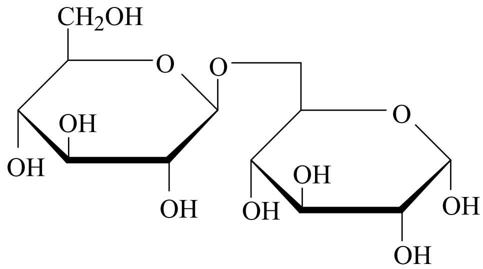


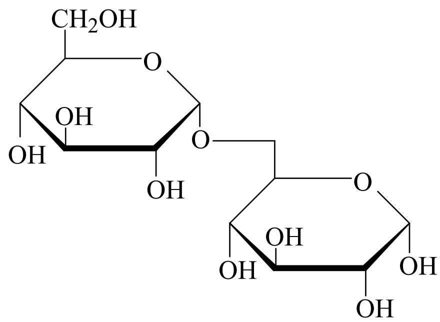


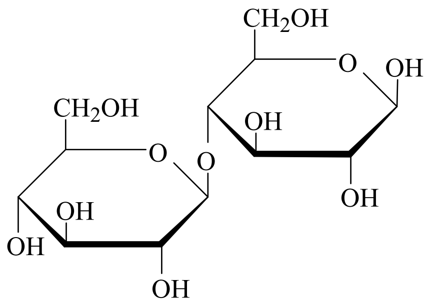
β – glucose

What is the structure of gentiobiose?

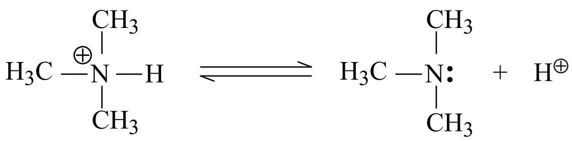
(a) 

(b) 

(c) 

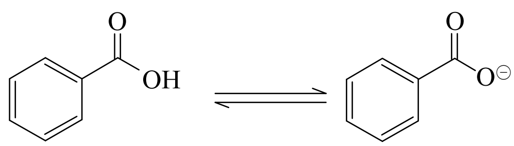
(d) 

11. Choose the answer that has correctly selected the major species of the following two acids to be present in blood naturally buffered at pH = 7.2.

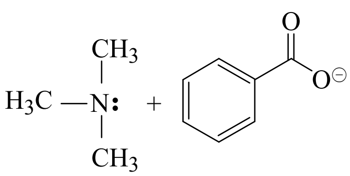


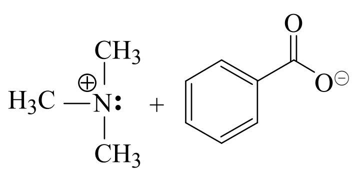
$pK_a = 9.8$

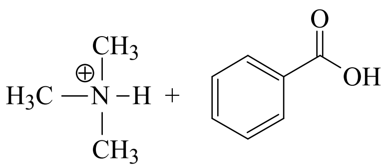
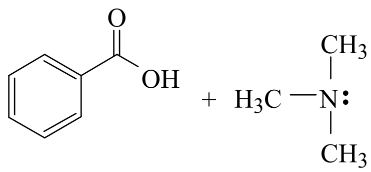
Acids　　　　Conjugate bases



$pK_a = 4.2$

(a) 

(b) 

(c)  (d) 

[Possible species in blood buffered at pH = 7.2]

12. Which one of the following is a non-reducing sugar?
(a) Glucose (b) Mannose (c) Fructose (d) Sucrose

13. Which of the following compounds will not show mutarotation?
(a) Methyl-α-D-glucopyranoiside
(b) α-D (+) glucospyranose
(c) β-D (+) glucopyranose
(d) β-D (+) galactopyranose

14. α-D-glucose and β-D-glucose are
(a) anomers (b) C_2-epimers (c) C_3-epimers (d) enantiomers

15. At isoelectric point, the amino acid has
(a) Least viscosity
(b) Maximum surface tension
(c) Minimum solubility
(d) All of these

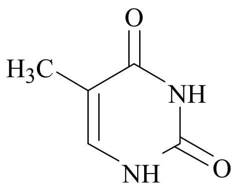
16. Which one of the following is not correct for monosaccharides?
(a) They are optically active polyhydroxy carbonyl compounds
(b) Fructose is ketose sugar and hence it does not give red precipitate with Fehling's solution
(c) α-D (+) glucose and β-D (+) glucose are anomers
(d) Glucose and mannose are epimers

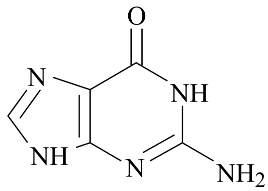
17. Which of the following is not a surfactant?
(a) $CH_3-(CH_2)_{15}-N^+(CH_3)_2-CH_3Br^-$ (b) $CH_3-(CH_2)_{14}-CH_2-NH_2$
(c) $CH_3-(CH_2)_{16}-CH_2OSO_2^-\ Na^+$ (d) $OHC-(CH_2)_{14}-CH_2-COO^-\ Na^+$

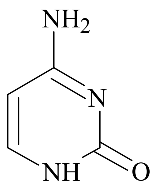
18. Tertiary structure of protein contains which type of forces?
(a) Electrostatic forces only
(b) Electrostatic as well as hydrogen bonds
(c) Electrostatic, hydrogen bonds and Vander waal forces
(d) Electrostatic, hydrogen bonds, Vander waal forces, dipole–dipole attractions and disulphide crosslinkage.

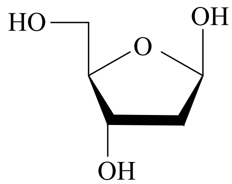
19. Which of the following is an addition and homopolymer?
(i) Neoprene (ii) Polystyrene (iii) Nylon-6,6 (iv) Nylon-6
(a) only i (b) i, ii and iv
(c) i and ii (d) i, ii, iii and iv

20. Identify structure of thymine

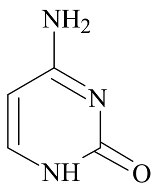
(a) 

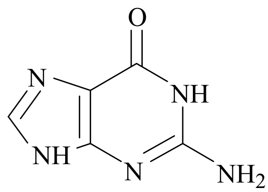
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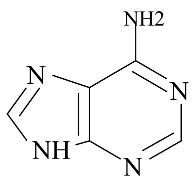
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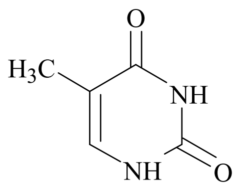
(d) 

21. Identify structure of adenine

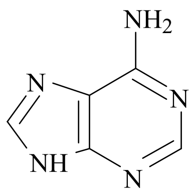
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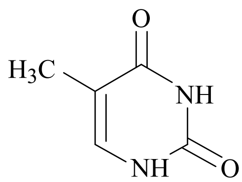
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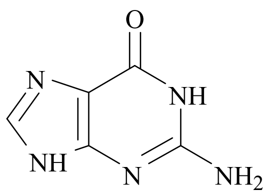
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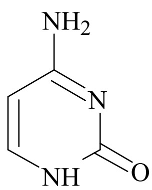
(d) 

22. Identify structure of cytosine

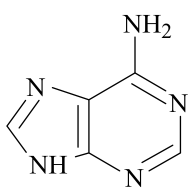
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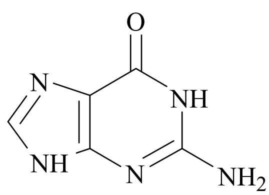
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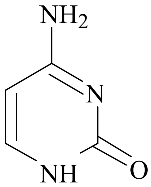
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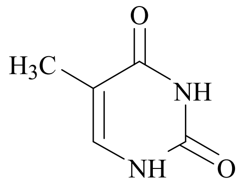
(d) 

23. Identify structure of guanine

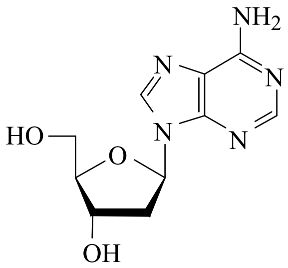
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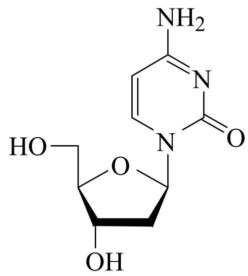
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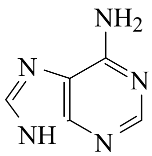
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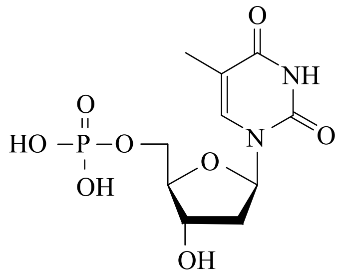
(d) 

24. Identify structure of adenine deoxyribo-nucleoside

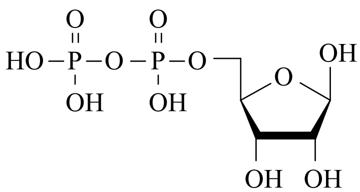
(a) 

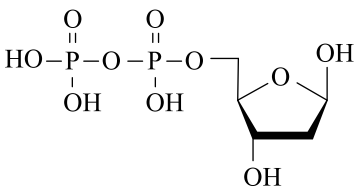
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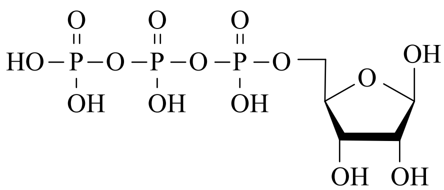
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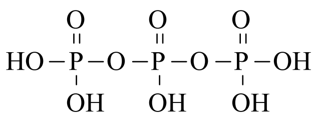
(d) 

25. Identify structure of Riboso-5-triphosphate

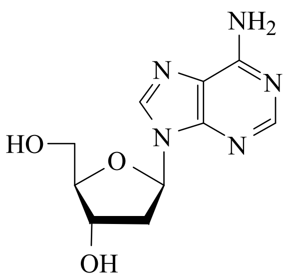
(a) 

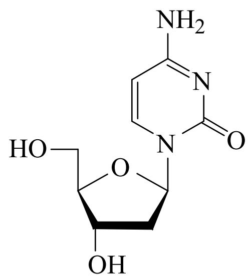
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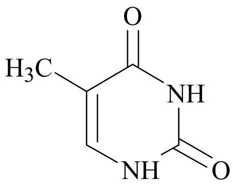
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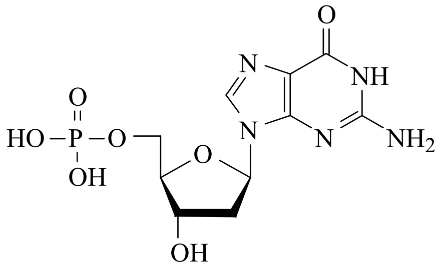
(d) 

26. Identify structure of Guanine deoxyribo-nucleotide

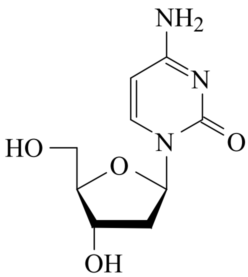
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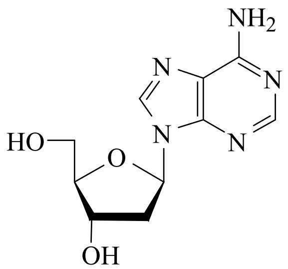
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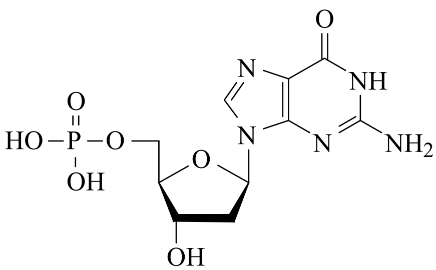
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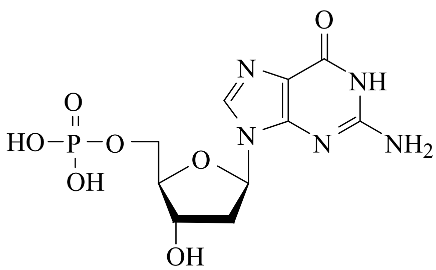
(d) 

27. Identify structure of Cytosine deoxyribo-nucleoside

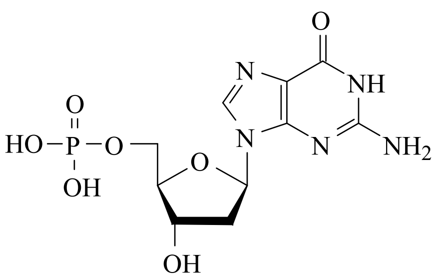
(a) 

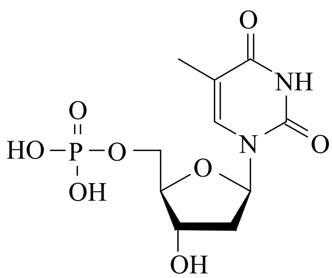
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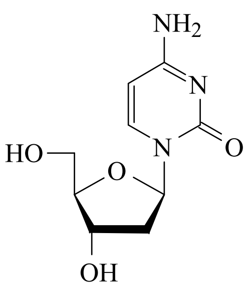
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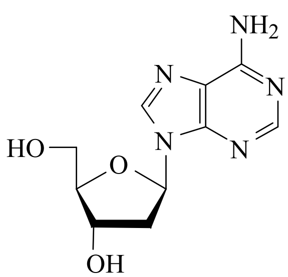
(d) 

28. Identify structure of Thymine deoxyribo-nucleotide

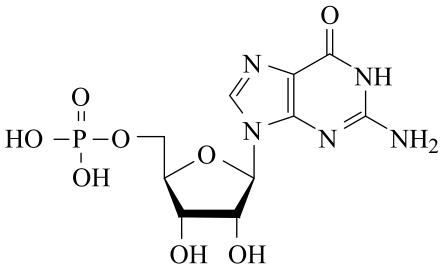
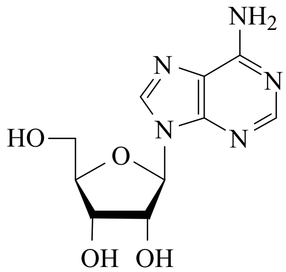
(a) 

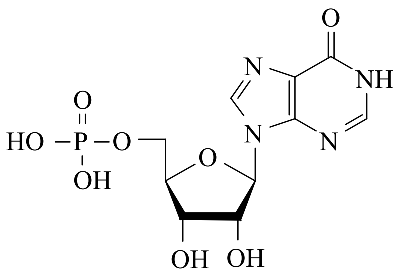
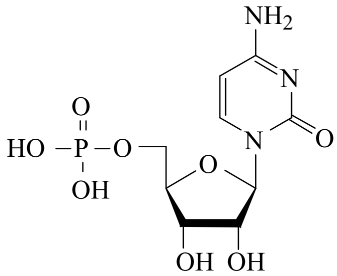
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(c) 

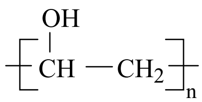
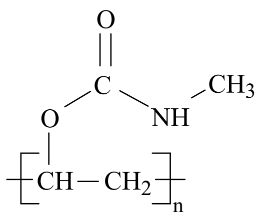
(d) 

29. Identify structure of Guanine ribonuleotide

(a)  (b) 

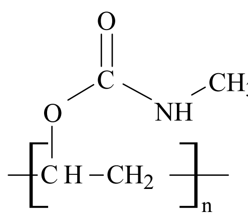
(c)  (d) 

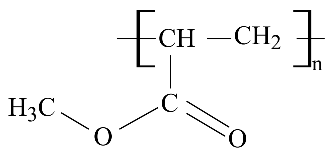
30. Identify structure of poly(diethylene glycol)

(a)  (b) 

(c) $\left[CH_2 - CH = CH - CH_2 \right]_n$ (d) $\left[CH_2 - CH_2 - O - CH_2 - CH_2 - O \right]_n$

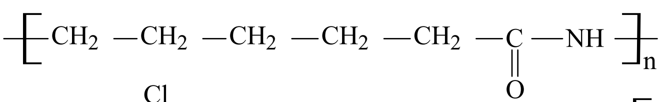
31. Identify structure of poly(methyl acrylate)

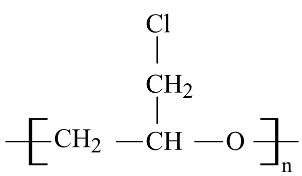
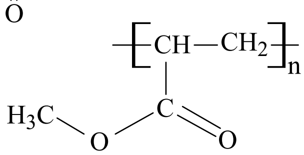
(a) $\left[CH_2 - CH_2 - O - CH_2 - CH_2 - O \right]_n$ (b) 

(c) $\left[CH_2 - CH = CH - CH_2 \right]_n$ (d) 

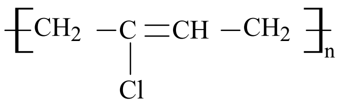
32. Identify structure of Nylon-6

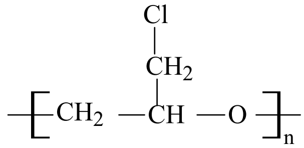
(a) $\left[CH_2 - CH_2 - O - CH_2 - CH_2 - O \right]_n$

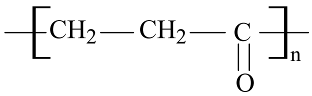
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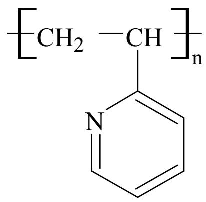
(c)  (d) 

33. Identify structure of neoprene

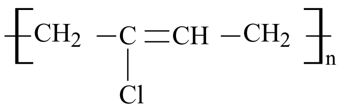
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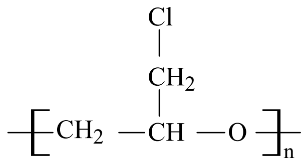
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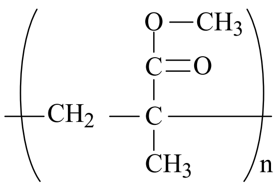
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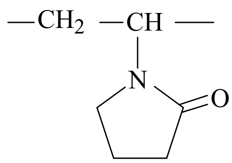
(d) 

34. Identify structure of poly(methylmetacrylate)

(a) 

(b) 

(c) 

(d) 

35. Among the following polymer identify homopolymer
(a) Nylon-6 (b) Buna-N (c) Buna-S (d) Polyethylene

36. Among the following polymers, identify the copolymer
(a) Nylon-6 (b) Starch (c) PVC (d) Protein

37. Which of these is a hypnotic?
(a) Metaldehyde (b) Acetaldehyde (c) Paraldehyde (d) None of these

38. An ester used as medicine is
(a) ethyl acetate (b) methyl acetate (c) methyl salicylate (d) ethyl benzoate

39. Nylon threads are made of
(a) polyvinyl polymer (b) polyester polymer
(c) polyamide polymer (d) polyethylene polymer

40. Paracetamol is an
(a) antibiotic (b) antipyretic (c) antimalarial (d) analgesic

41. Antiseptic, chlorozylenol is
(a) 4-chloro-3,5-dimethyl phenol (b) 3-chloro-4,5-dimethyl phenol
(c) 4-chloro-2,5-dimethyl phenol (d) 5-chloro-3,4-dimethyl phenol

42. Phenacetin is used as on
(a) antipyretic (b) antiseptic (c) analgesic (d) antimalarial

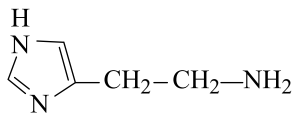
43. Which of the following colours is imparted by alizarin dye in the presence of Cr^{3+} ion?
(a) Violet (b) Brown-red (c) Pink (d) Red

44. Which of the following polymers can be used for lubrication and as an insulator?
(a) SBR (b) PVC (c) PTFE (d) PAN

45. A hybrid rocket propellant uses
(a) a liquid oxidiser and a solid fuel (b) a composite solid propellant
(c) a biliquid propellant (d) a solid liquid and gas as a propellant

46. Buna-N synthetic rubber is a copolymer of
(a) $H_2C{=}CH{-}\underset{\text{C}}{\overset{\text{Cl}}{|}} = CH_2$ and $H_2C = CH - CH = CH_2$
(b) $H_2C = CH - CH = CH_2$ and $H_5C_6 - CH = CH_2$
(c) $H_2C = CH - CN$ and $H_2C = CH - CH = CH_2$
(d) $H_2C = CH - CN$ and $H_2C = CH - \underset{\text{C}}{\overset{\text{Cl}}{|}} = CH_2$

47. Among cellulose, polyvinyl chloride, nylon and natural rubber, the polymer in which the intermolecular force of attraction is weakest is
(a) nylon (b) polyvinyl chloride
(c) cellulose (d) natural rubber

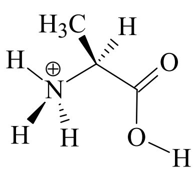
48. The drug  is used as an
(a) antacid (b) analgesic (c) antimicrobial (d) antiseptic

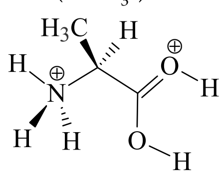
49. What is the complementary RNA sequence for the DNA segment AATCAGTT?
(a) AAUCAGUU (b) CCAUCGAA (c) AACUGAUU (d) UUAGUCAA

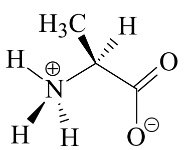
50. In DNA replication the complementary nucleotide sequence for 5′-ACGT-3′ is which of the following?
(a) 3′-ACGT-5′ (b) 3′-TGCA-5′ (c) 5′-AGCT-3′ (d) 5′-TCGA-3′

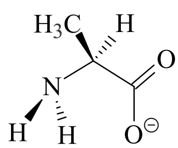
51. Which of the following is not a disaccharide?
(a) sucrose (b) mannose (c) lactose (d) maltose

52. Shown below are five representations of the molecule alanine. Which one best represents the structure of alanine in the blood stream (a buffered solution of about pH 7.4)? The pk_a values for alanine are 2.3 ($-CO_2H$) and 9.7 ($-NH_3^+$).

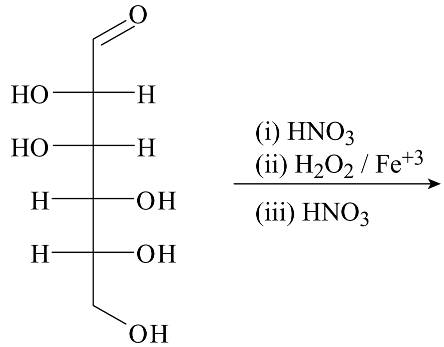
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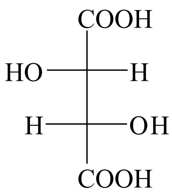
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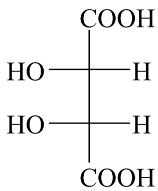
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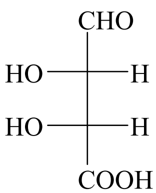
(d) 

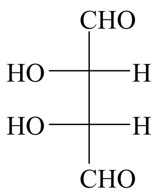
53. Identify the final product of the reaction



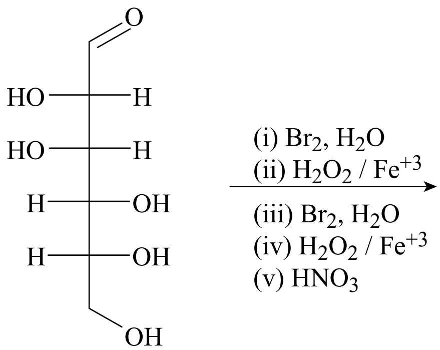
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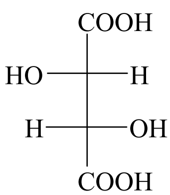
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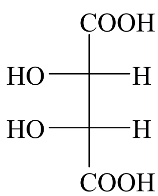
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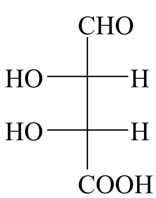
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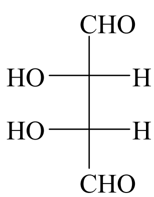
54. Identify the final product of the reaction



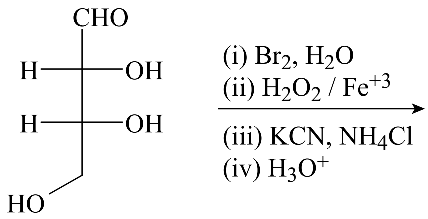
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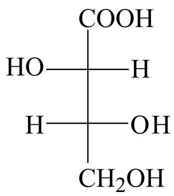
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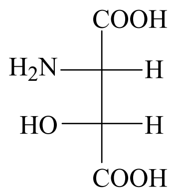
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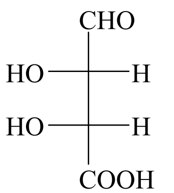
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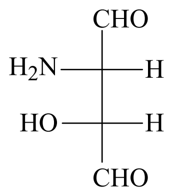
55. Identify the final product of the reaction



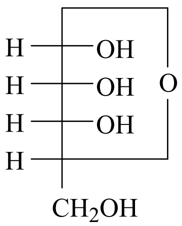
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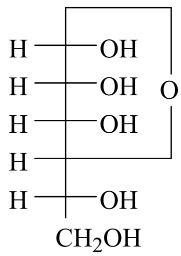
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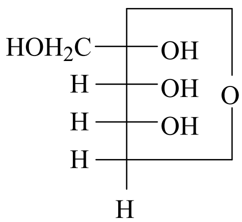
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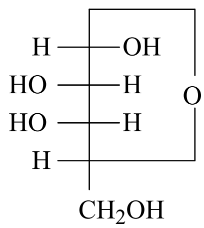
(d) 

56. Identify structure of α-D-Lyxofuranose

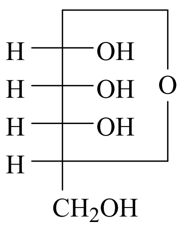
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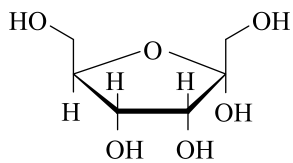
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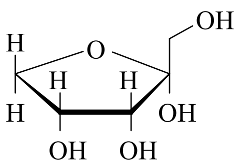
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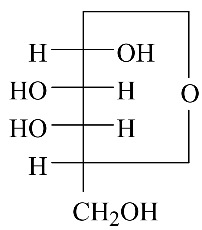
(d) 

57. Identify structure of α-D-Ribulofuranose

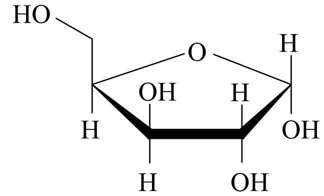
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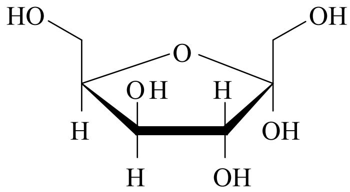
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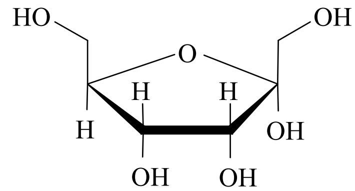
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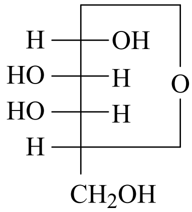
(d) 

58. Identify structure of α-D-Xylofuranose

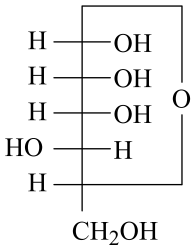
(a) 

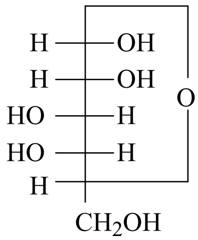
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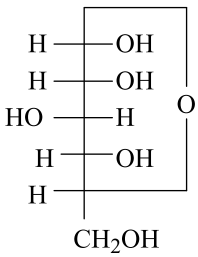
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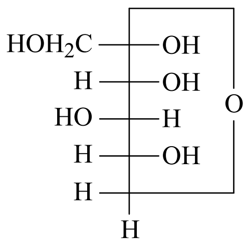
(d) 

59. Identify structure of α-D-Glucopyranose

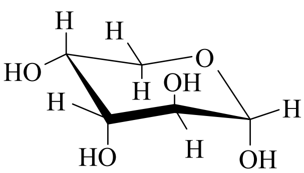
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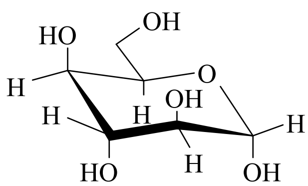
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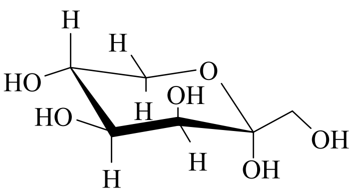
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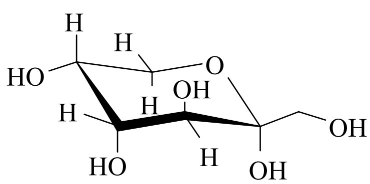
(d) 

60. Identify structure of α-D-Arabinopyranose

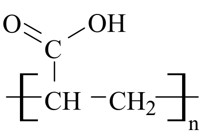
(a) 

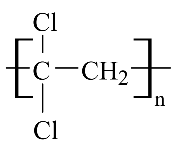
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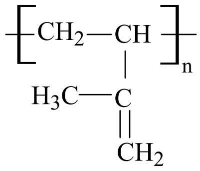
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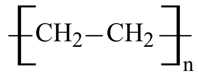
(d) 

61. Identify structure of polyethene

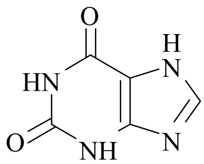
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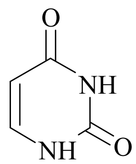
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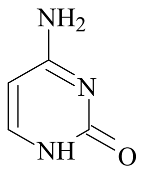
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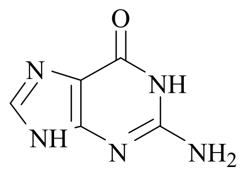
(d) 

62. Identify structure of guanine

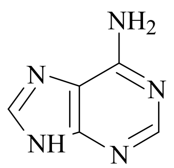
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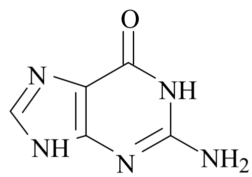
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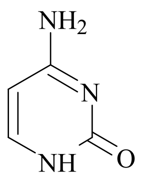
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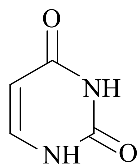
(d) 

63. Identify structure of adenine

(a) 

(b) 

(c) 

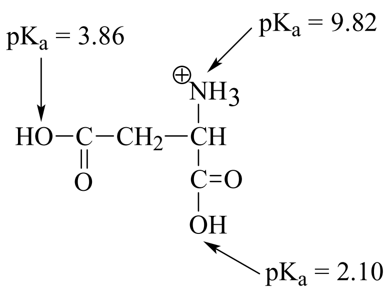
(d) 

64. The pupils of eyes are dilated with a very dilute solution of an alkaloid which is

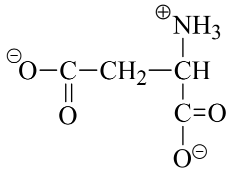
(a) adrenaline (b) atropine

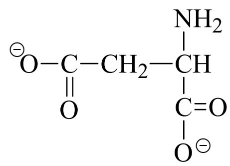
(c) equanil (d) ephedrine

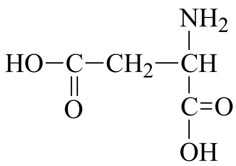
65. The pK_a values of aspartic acid, a naturally occurring amino acid are shown to the right. Choose from below, the structure of the major species present at a pH of 7.2.

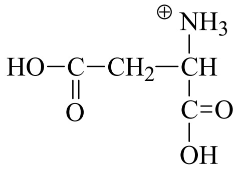


Assorbic acid pK_a values

(a) 

(b) 

(c) 

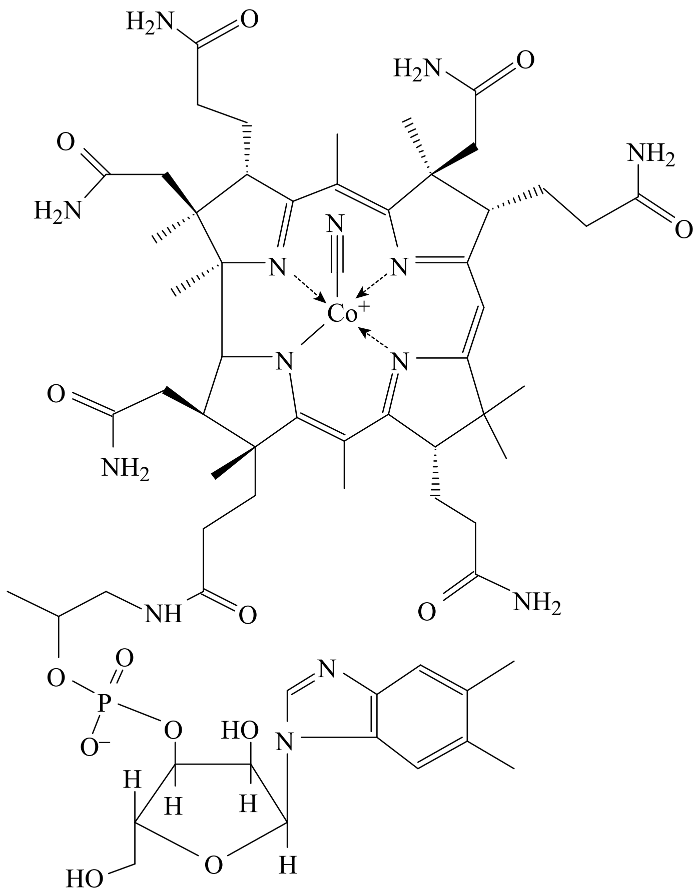
(d) 

66. Penicillin was first discovered by
(a) A. Fleming (b) L. Pasteur (c) G. Thompson (d) A. Noble

67. The poisonous gas evolved in Bhopal tragedy was
(a) $COCl_2$ (b) CH_3NCO (c) CH_3CN (d) CO

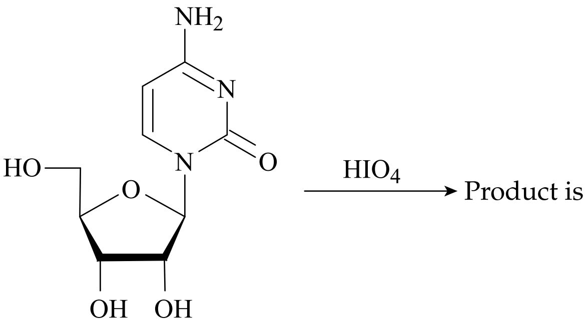
68. In making lemon pickle
(a) chillies are used to kill all germs and bacteria
(b) lemon oil acts as a preservative
(c) salt plays the same role as sugar in jam
(d) citric acid acts as a preservative

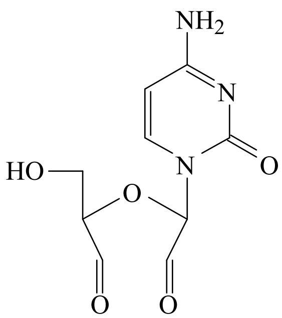
69. Identify the sugar present in vitamin B_{12}

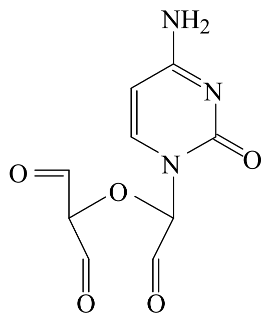


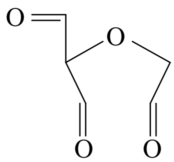
Vitamin B_{12}

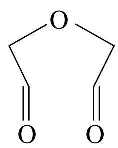
(a) Triose (b) Pentose
(c) Hexose (d) Tetrose

70. 

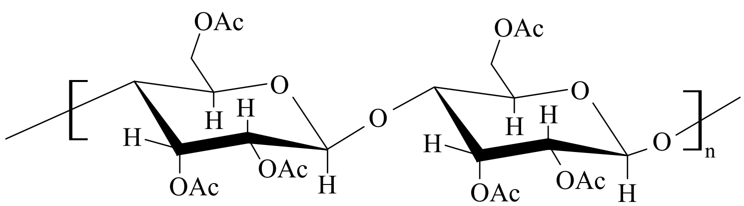
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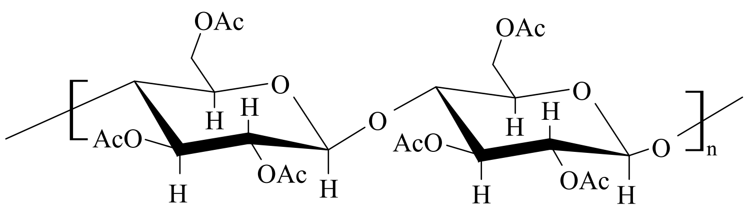
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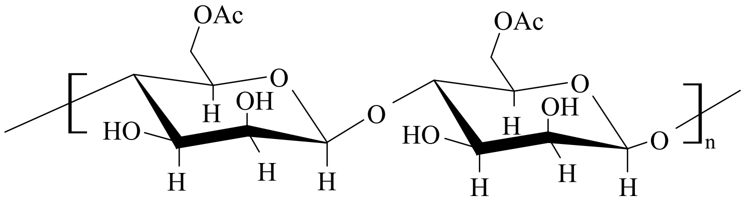
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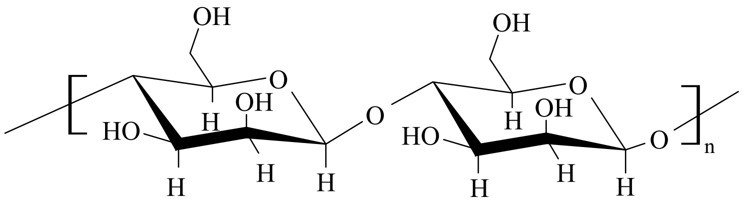
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71. Identify structure of cellulosetriacetate is

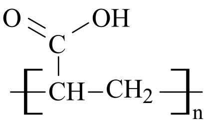
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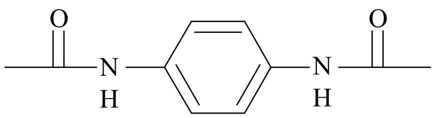
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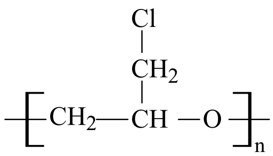
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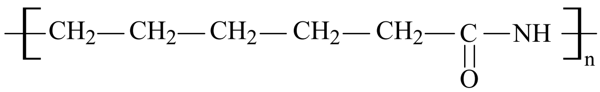
(d) 

72. Identify the structure which gives Biurate test

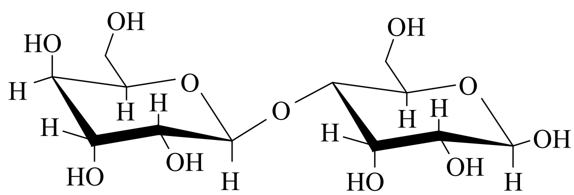
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(b) 

(c) 

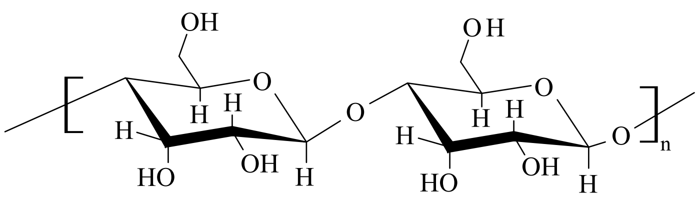
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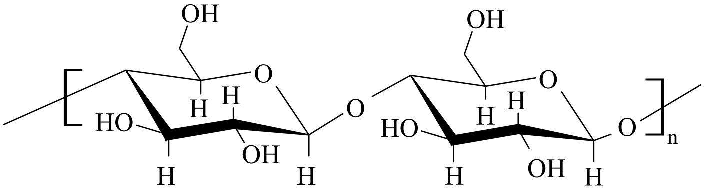
73. Identify the correct statement about the following disaccharide

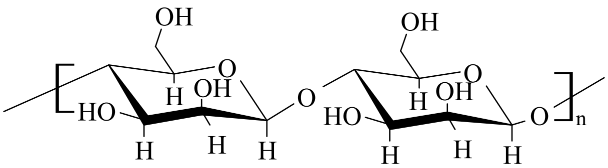


(a) Both rings are pyranose
(b) Reducing sugar
(c) Non-reducing sugar
(d) (a) and (b) both are correct

74. Identify the structure of cellulose

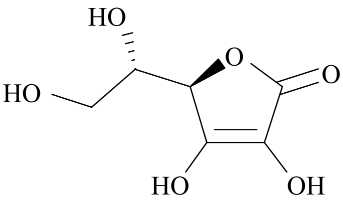
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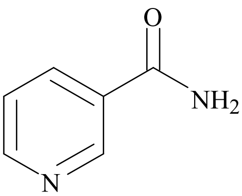
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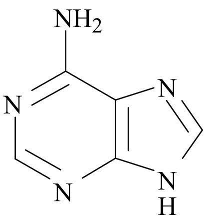
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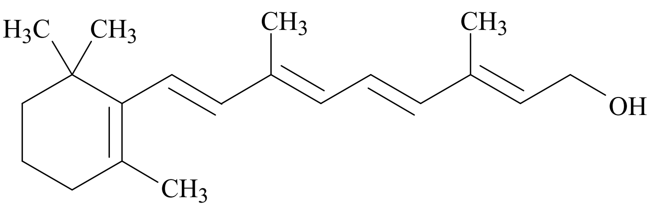
(d) $-\!\!\left[CH_2-CH_2-CH_2-CH_2-CH_2-\underset{\underset{O}{\|}}{C}-NH\right]_n\!\!-$

75. Identify the structure of Vitamin C

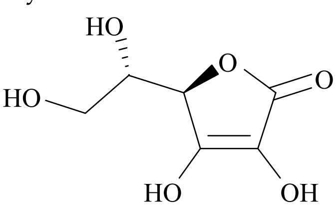
(a) 

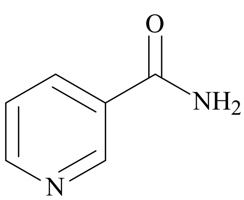
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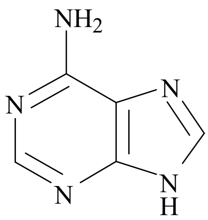
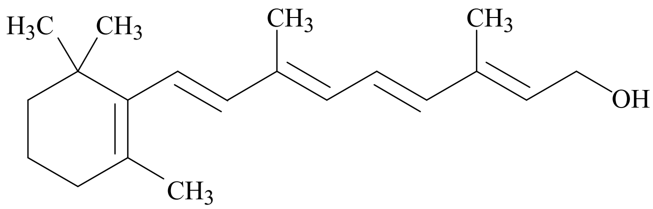
(c) 

(d) 

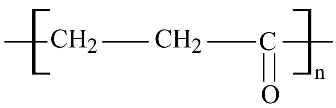
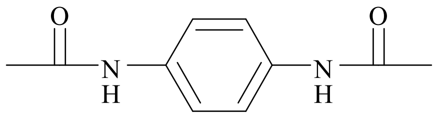
76. Identify the structure of Vitamin A

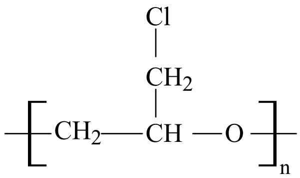
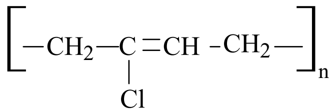
(a) 

(b) 

(c) 
(d) 

77. Identify the structure of neoprene

(a) 
(b) 

(c) 
(d) 

78. Synthetic polymer which resembles natural rubber is
(a) chloroprene (b) glyptal (c) nylon (d) neoprene

79. D-(+)-Glucose shows mutarotation because
(a) it undergoes interconversion with D-(–)-fructose
(b) it undergoes interconversion between its pyranose structure and furanose structure
(c) it undergoes interconversion between its α-D-(+)-glucopyranose and β-D-(+)-glucopyranose structures via the open-chain structure
(d) it is dextrorotatory

80. Which of the following is not a biopolymer?
(a) Nucleic acid (b) Rubber (c) Protein (d) Starch

81. Lysergic acid diethylamide (LSD) is
(a) antibiotic (b) synthetic fibre
(c) psychedelic drug (d) sweetening agent

82. PVC polymer can be prepared by which of the monomers?
(a) $H_2C=CHCl$ (b) $C_6H_5CH=CH_2$ (c) $CH_3CH=CH_2$ (d) $H_2C=CH_2$

83. Diabetes is detected by testing the urine of a patient usually with
(a) Benedict's reagent (b) Nessler's reagent
(c) Fenton's reagent (d) Tollen's reagent

84. Which of the following sets contains only addition polymers?
(a) Bakelite, PVC, polyethylene (b) Polyethylene, PVC, acrilon
(c) Buna-S, nylon, polybutadine (d) Polyethylene, polypropylene, terylene

85. Which of the following is an example of azo dye?
(a) Malachite green (b) Congo red
(c) Martius yellow (d) Indigo

86. Which of the following is not an example of natural polymer?
(a) Leather (b) Silk (c) Wool (d) Nylon

87. Heroin is a derivative of
(a) nicotine (b) morphine (c) cocaine (d) caffeine

88. Which of the following fibres is not made up of polyamides?
(a) Natural silk (b) Artificial silk (c) Wool (d) Nylon

89. An aldose is converted into its next higher homologue by
(a) Amadori rearrangement (b) Wohl's method
(c) Killiani's reaction (d) Mutarotation

90. Nylon is
(a) polyethylene methyl acrylate fibre (b) polyamide fibre
(c) polythene derivative (d) polyester fibre

91. Polythene is a resin obtained by polymerisation of
(a) butadiene (b) ethylene (c) styrene (d) isoprene

92. Which of the following is used as an antipyretic?
(a) Chloroquine (b) Paracetamol
(c) Chloramphenicol (d) LSD

93. Point out the wrong statement
(a) Phenacetin is a very important antibiotic
(b) Penicillin was discovered by A. Flemming
(c) Chloroquine is an antimalarial drug
(d) Ether is an anaesthetic

94. The aqueous solution of carbohydrate gave a dark blue colour with iodine solution. The carbohydrate is
(a) glucose (b) sucrose (c) fructose (d) starch

95. Aspirin is a/an
(a) anaesthetic (b) antipyretic (c) tranquillizer (d) narcotic

96. Which one of the following is a protein fibre?
(a) Rayon (b) Cotton (c) Silk (d) Polyester

97. The monomers used in the manufacture of nylon-6, 6 are
(a) adipic acid and butadiene (b) sebacic acid and hexamethylene diamine
(c) sebacic and butadiene (d) adipic acid and hexamethylene diamine

98. The antibiotic used for the treatment of typhoid is
(a) penicillin (b) terramycin
(c) chloramphenicol (d) sulphadiazine

99. A polyamide synthetic polymer prepared by prolonged heating of caprolactum is
(a) glyptal (b) nylon-6 (c) nylon-6, 10 (d) nylon-6, 6

100. Reserine is
(a) harmone (b) antibiotic (c) vitamin (d) tranquilizer

101. Which one of the following is a chromophore group?
(a) $-SO_3H$ (b) –OH (c) –N = N– (d) $-NH_2$

102. The specific rotation of a freshly prepared solution of α-D-glucose changes from a value of x° to a constant value of y°. The value of x and y are respectively
(a) 112° and 52.5° (b) 19° and 52.5° (c) 52.5° and 19° (d) 52.5° and 112°

103. The basic dye among the following is
(a) congo red (b) antiline yellow (c) alizarin (d) indigo

104. Which of the following is an chain growth polymer?
(a) Glyptal (b) Pholypropylene (c) Nylon-6 (d) Nylon-6, 6

105. Starch is a polymer of
(a) ribose (b) glucose (c) lactose (d) fructose

106. The presence of carbohydrate in a sample can be detected by
(a) Benedict's test (b) Tollen's test (c) Biuret test (d) Molish test

107. Which of the following is an example of condenasation polymer?
(a) Nylon-6, 6 (b) Bakelite (c) Buna-S rubber (d) All of these

108. Molisch test is used for the detection of
(a) alkaloid (b) carbohydrates (c) alkyl halide (d) fats

109. In making lemon pickle
(a) citric acid acts as a preservative
(b) lemon oil acts as a preservative
(c) salt plays the same role as sugar in jam
(d) chillies are used to kill all germs and bacteria

110. Neoprene is a polymer of
(a) butadiene (b) isoprene (c) styrene (d) chloroprene

111. Which of the following is an antibiotic?
(a) Paracetamol (b) Aspirin (c) Terramycin (d) Chloroquine

112. Hydrazine as a drug is used in the treatment of
(a) typhoid (b) malaria (c) cholera (d) tuberculosis

113. Arsenic drugs are mainly used in the treatement of
(a) jaundice (b) syphilis (c) typhoid (d) cholera

114. Sorbitol can be obtained by the reduction of
(a) fructose (b) glucose (c) sarbose (d) all of these

115. Bakelite is obtained from phenol by reacting with
(a) chlorobenzene (b) acetaldehyde
(c) formaldehyde (d) acetal

116. Which of the following is an alkaloid?
(a) Cocaine (b) Atropine (c) Nicotine (d) All of these

117. A raw material used in making nylon is
(a) isoprene (b) butadiene (c) adipic acid (d) ethylene

118. Polypropylene is not used in
(a) clothes (b) parachute ropes
(c) ropes (d) heat-resistant plastics

119. The drug which is effective in curing malaria is
(a) analgin (b) aspirin (c) salol (d) quinine

120. A substance which can act both as an antiseptic and disinfectant is
(a) phenol (b) aspirin (c) analgin (d) sodium pentothal

121. Dacron is an example of
(a) polypropylene (b) polyamide
(c) polyurethane (d) polyester

122. Which of the following is used as an anaesthetic?
(a) CO_2 (b) N_2O (c) CH_4 (d) N_2

123. Dettol consists of
(a) cresol + ethanol (b) chloroxylenol + terpeneol
(c) xylenol + terpeneol (d) none of the above

124. The pupils of eyes are dilated with a very dilute solution of an alkaloid which is
(a) atropine (b) adrenaline (c) equanil (d) ephedrine

125. Orlon is a unit of
(a) vinylcyanide (b) acrolein (c) glycol (d) isoprene

126. Penicillin was first discovered by
(a) A. Noble (b) L. Pasteur (c) G. Thompson (d) A. Fleming

127. The substances which relieve anxiety, reduce mental tension and induce sleep are called
(a) tranquillizers (b) antipyretics (c) analgesics (d) anaesthetics

128. To which class of dyes does phenolphthalein belong?
(a) Phthalein dyes (b) Nitro dyes
(c) Triphenylmethane dyes (d) Azo dyes

129. The poisonous gas evolved in Bhopal tragedy was
(a) CH_3CN (b) CH_3NCO (c) $COCl_2$ (d) CO

130. (+)-Sucrose is made up of
(a) L-fructose and L-glucose (b) D-glucose and L-fructose
(c) D-fructose and L-glucose (d) D-glucose and L-fructose

131. Which of the following sugars is obtained from nature, usually in a levorotaory form?
(a) Maltose (b) Fructose (c) Sucrose (d) Glucose

132. An example of natural biopolymer is
(a) rubber (b) nylon (c) teflon (d) DNA

133. In the ring structure of fructose, the anomeric carbon is
(a) C-6 (b) C-5 (c) C-2 (d) C-1

134. Monosaccharides are assigned D- or L-configuration depending upon whether its standard Fischer projection formula has a right or left orientation respectively of the hydroxy group at the
(a) anomeric carbon (b) bottom most asymmetric carbon
(c) carbon number 2 (d) topmost asymmetric carbon

135. Teflon is a polymer of the monomer
(a) $CHCl = CHCl$ (b) $CHF = CHCl$ (c) $CHF = CH_2$ (d) $F_2C = CF_2$

136. Cane sugar and invert sugar are
(a) levorotatory and dextrorotatory respectively
(b) dextrorotatory and levorotatory respectively
(c) both levorotatory
(d) both dextrorotatory

137. The major compound of sugar present in honey is
(a) lactose (b) glucose (c) invert sugar (d) sucrose

138. Which one of the following statements is wrong?
(a) PVC stands for polyvinyl chloride
(b) Buna-S stands for natural rubber
(c) PTFE stands for teflon
(d) PMMA stands for polymethyl methyl acrylate

139. Cellulose is a linear polymer of
(a) α-D-fructose (b) β-D-glucose (c) α-D-glucose (d) β-D-fructose

140. Aldoses can be differentiated from ketoses by
(a) periodic acid (b) Tollen's reagents (c) bromine water (d) both (a) and (c)

141. Which of the following sugars exhibits mutarotation?
(a) Fructose (b) Glucose (c) Lactose (d) All of these

142. Heating of rubber with sulphur is known as
(a) vulcanisation (b) bessemerisation (c) galvanisation (d) sulphonation

143. Which of the following is the C-2 epimer of D-glucose?
(a) D-Fructose (b) L-Glucose (c) D-Galactose (d) D-Mannose

144. Glucose reacts with an excess of phenylhydrazine to form
(a) glucosone (b) glucose phenylhydrazone
(c) glucosazone (d) fructose phenlhydrazone

145. Which of the following is a natural polymer?
(a) Bakelite (b) Polythene (c) Buna-S (d) Protein

146. Which of the following pairs of sugars form identical osazone derivative?
(a) D-(+)-Glucose and D-(–)-arabinose (b) D-(+)-Glucose and D-(–)-fructose
(c) D-(+)-Glucose and (+)-maltose (d) D-(+)-Glucose and (+)-lactose

147. Which of the following sugars forms an osazone derivative which is identical with that of D-glucose?
(a) D-Mannose (b) D-Galactose (c) D-Fructose (d) Both (a) and (c)

148. Upon hydrolysis lactose breaks down into
(a) glucose and arabinose
(b) glucose and fructose
(c) glucose and galactose
(d) glucose and mannose

149. Cellulose is a linear polymer of
(a) β-glucose (b) α-fructose (c) α-glucose (d) amylose

150. On hydrolysis of starch, we finally get
(a) sucrose (b) glucose (c) fructose (d) both (b) and (c)

151. D-glucose and D-fructose all form the same osazone derivative because all of them have
(a) the same configuration at C-5
(b) the same constitution at C-1 and C-2
(c) the same constitution
(d) the same constitution and configuration at C-3, C-4, C-5 and C-6 but different constitution and configuration at C-1 and C-2 which becomes identical by osazone formation

152. The fibre obtained by the condensation of hexamethylene diamine and adipic acid is
(a) nylon-6, 6 (b) dacron (c) rayon (d) teflon

153. In the formation of osazone derivatives of aldohexoses and ketohexoses, the carbon atom(s) that participate(s) in the reactions is
(a) C-1 and C-2 (b) C-2 and C-3 (c) C-1 (d) C-2

154. In an aqueous solution of D-glucose the percentages of α- and β-anomer at the equilibrium condition are respectively
(a) 20% and 80% (b) 80% and 20% (c) 36% and 64% (d) 64% and 36%

155. Which of the following is a polysaccharide?
(a) Cellobiose (b) Polyethene (c) Cellulose (d) Nylon

156. Which one of the following is a thermosetting polymer?
(a) SBR (b) Nylon-6, 6 (c) Bakelite (d) Nylon-6

157. Glucose gives postive silver mirror test with ammoniacal silver nitrate because it contains
(a) aldehyde group
(b) hydroxy group
(c) ketone group
(d) vicinal diol group

158. Which functional groups of glucose interact to from cyclic heiacetal leading to pyranose structure?
(a) Ketone group at C-2 and hydroxy group at C-5
(b) Aldehyde group and hydroxy group at C-5
(c) Aldehyde group and hydroxy group at C-4
(d) Aldehyde group and hydroxy group at C-6

159. Which of the following reagents may be used to identify glucose?
(a) $NaHSO_3$
(b) Ammoniacal $AgNO_3$ solution
(c) $CHCl_3$ and alcoholic KOH
(d) Neutral $FeCl_3$ solution

160. Fructose reduces Fehling's solution due to the presence of
(a) hydroxy group (b) ketone group
(c) aldehde group (d) α-hydroxyketone group

161. Natural rubber is a polymer of
(a) butadiene (b) isoprene (c) chloroprene (d) neoprene

162. The formation of furanose structure of fructose involves the interaction of functional groups present at
(a) C-1 and C-4 (b) C-1 and C-5 (c) C-2 and C-5 (d) C-2 and C-6

163. The widely used plastic PVC is a polymerisation product of
(a) $CHCl=CHCl$ (b) $H_2C=CCl_2$
(c) $H_2C=CH_2$ (d) $H_2C=CHCl$

164. D-Glucose reacts with anhydrous methyl alcohol in the presence of dry HCl gas to form
(a) β-methyl D-glucopyranside
(b) α-methyl D-glucopyranoside
(c) 2, 3, 4, 5, 6-penta-O-methyl D-glucose
(d) both (a) and (b)

165. Consider the following sequence of reactions

$$\text{Glucose} \xrightarrow[\text{(excess)}]{PhNHNH_2} A \xrightarrow[\text{heat}]{H_3O^+} B \xrightarrow{Zn/AcOH} C$$

The product (C) is expected to be
(a) mannose (b) fructose (c) sorbitol (d) arabinose

166. Which of the following fibres is made of polyamides?
(a) Raon (b) Orlon (c) Nylon (d) Dacron

167. In the multi-step conversion of an aldose into next higher aldose by Kiliani-Fischer synthesis, the reagent emplyed in the first step is
(a) HCN (b) NH_2OH (c) Br_2/H_2O (d) $C_6H_5NHNH_2$

168. Salol can be used as
(a) antiseptic (b) antipyretic (c) both (a) and (b) (d) none of these

169. When methyl D-glucopyranoside is oxidised with periodic acid, how many moles of the oxidising agent are consumed per mole of the sugar?
(a) 2 (b) 3 (c) 4 (d) 5

170. The urine of a diabetic patient contains
(a) glucose (b) fructose (c) sucrose (d) galactose

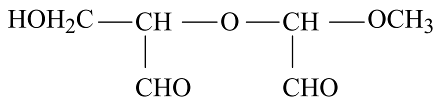
171. D-Glucose and D-mannose are
(a) epimers (b) anomers (c) diastereomers (d) both (a) and (c)

172. In which of the following sets do the carbohydrates contain disaccharides only?
(a) Maltose, lactose, starch (b) Sucrose, lactose, cellulose
(c) Maltose, sucrose, lactose (d) Maltose, lactose, mannose

173. When glucose is treated with an excess of HIO_4, the products formed are
(a) one mole of oxalic acid (COOHCOOH), three moles of HCOOH and one mole of HCHO
(b) five moles of HCOOH and one mole of HCHO
(c) one mole of glyoxal (CHOCHO), one mole of HCHO and three moles of HCOOH
(d) six moles of HCOOH

174. Malisch test is performed for the detection of
(a) carbohydrates (b) fats (c) alkaloids (d) alkyl halides

175. Methyl D-glucoside on reaction with HIO_4 consumes two moles of the reagent and produces the dialdehyde (A) and one mole of HCOOH.



(A)

The result of this reaction proves that glucose has
(a) a four-membered ring structure (b) a furanose structure
(c) an open-chain structure (d) a pyranose structure

176. Plants store their reserve carbohydrates in the form of
(a) starch (b) cellulose (c) glycogen (d) cellobiose

177. Which one is an example of vat dye?
(a) Indigo (b) Alizarin (c) Malachite green (d) Congo red

178. Starch consists of two polymeric units, namely
(a) glycogen and collagen (b) cellulose and cellobiose
(c) amylose and amylopectin (d) inulin and pectin

179. Ampicillin is
(a) an antibiotic (b) an analgesic (c) an antimalarial (d) an antipyretic

180. Charring of sugar is due to
(a) reduction and hydration (b) reduction
(c) dehydration (d) oxidation

181. Isoprene substances are used for making
(a) natural rubber (b) propane (c) petrol (d) liquid fuel

182. Glucose gives silver mirror with ammoniacal silver nitrate because it has
(a) ketone (b) aldehyde (c) ester (d) alcoholic $AgNO_3$

183. Lactose on hydrolysis gives
(a) glucose + galactose (b) fructose
(c) fructose + glucose (d) glucose

184. Chloroquine is
(a) an antipyretic (b) an antibiotic (c) an antimalarial (d) an analgesic

185. Terylene is a condensation polymer of ethylene glycol and
(a) salicylic acid (b) terephthalic acid
(c) benzoic acid (d) phthalic acid

186. Which of the following groups would you introduce into a dye to make it water soluble?
(a) $-NO_2$ (b) $-SO_3H$ (c) $-Cl$ (d) $-OH$

187. Polymer obtained by condensation polymerisation is
(a) PVC (b) teflon
(c) polythene (d) phenol–formaldehyde resin

188. A dye absorbs the wavelength corresponding to blue colour of light. The observed colour will be
(a) blue (b) orange (c) green (d) red

189. The product of addition polymerisation reaction is
(a) polythene (b) glyptal (c) nylon (d) terylene

190. With which of the following cations, alizarin will impart a violet colour on the fabrics?
(a) Cr^{3+} (b) Fe^{3+} (c) Ba^{2+} (d) Al^{3+}

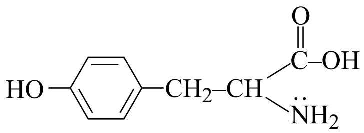
191. Glucose cannot be classified as
(a) a hexose (b) a carbohydrate
(c) an aldose (d) an oligosaccharide

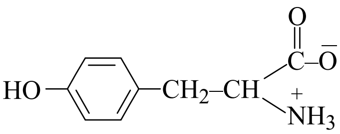
192. In the molecule of D-fructofuranose, the anomeric carbon is
(a) C-5 (b) C-2 (c) C-1 (d) C-6

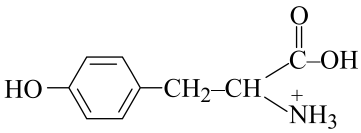
193. Glucose is treated with excess of HIO_4. How many moles of HIO_4 will be consumed per mole of the sugar?
(a) 5 (b) 4 (c) 3 (d) 2

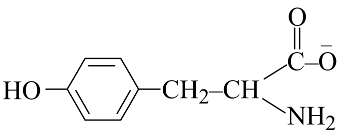
LEVEL 2

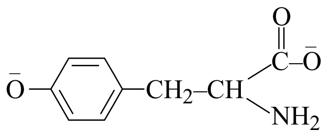
Single and Multiple-choice Type

1. Which of the following represents (tyrosine)  at a pH = 2 and pH = 12?

(a) 

(b) 

(c) 

(d) 

2. Which of the following is/are co-polymer (s)?

(a) Nylon-66 (b) Bakelite (c) Teflon (d) Polystyrene

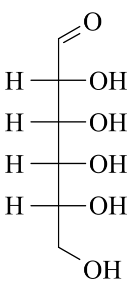
3. Which of the following do not undergo hydrolysis?

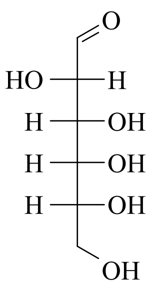
(a) Glucose (b) Fructose (c) Cane sugar (d) Maltose

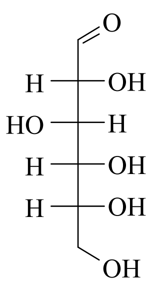
4. Among the following polymers, peptide linkage is present in

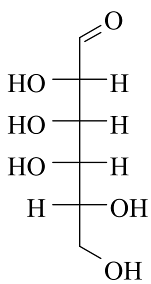
(a) Nylon-66 (b) Protein (c) Nylon-6 (d) Tafflon

5. Identify the compound that gives same Osazone

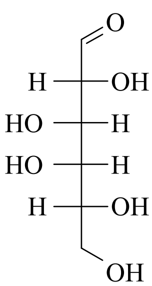
(a) 

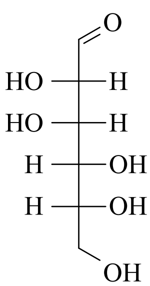
(b) 

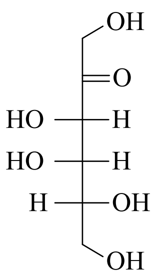
(c) 

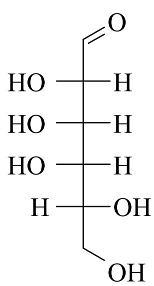
(d) 

6. Identify the compound that gives same Osazone

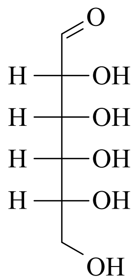
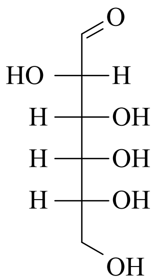
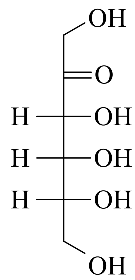
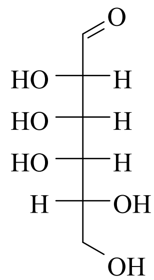
(a) 

(b) 

(c) 

(d) 

7. Identify the compounds which are inter-convertible in basic medium

(a)  (b)  (c)  (d) 

8. Among the following polymers, identify the co-polymer
(a) Nylon-6 (b) Buna-N (c) Buna-S (d) Protein

9. Among the following polymers, identify the co-polymer
(a) Terylene (b) Glyptal (c) PVC (d) Protein

10. Among the following polymers, identify the homopolymer
(a) Bakelite (b) Dacron (c) Natural rubber (d) Orlon

Comprehension Type

Passage 1

Amino acids contain both a basic group ($-NH_2$) and an acidic group ($-CO_2H$). In the dry solid state, amino acids exist as dipolar ions, a form in which the carboxylic group is present as a carboxylate ion, $-CO_2^-$ and the amino group is present as on amonium ion, $-NH_3^{\oplus}$. In aqueous solution, an equilibrium exists between the dipolar ion (zwitter ions) and the anionic and cationic forms of an amino acid.

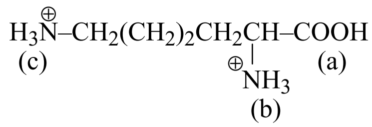
$$\underset{\text{Cationic form }(K_{a_1})}{H_3\overset{\oplus}{N}-\underset{R}{CH}-COOH} \underset{+H_3O^{\oplus}}{\overset{-H_3O^{\oplus}}{\rightleftharpoons}} \underset{\substack{\text{Dipolar ion }(K_{a_2})\\ \text{(Zwitter ion)}}}{H_3\overset{\oplus}{N}-\underset{R}{CH}-COO^{\ominus}} \rightleftharpoons \underset{\text{Anionic form}}{H_2N-\underset{R}{CH}-COO^{\ominus}}$$

In strongly acidic solutions (pH ≈ 0) all amino acids are present primarily as cations, in strongly basic solution they are present as anions. At some intermediate pH, called the isoelectric point (pI), the concentration of the anions and cations is equal. Each amino acid has particular isoelectric point.

11. For the phenyl alanine, the first and second dissociation constants are given as $pK_{a_1} = 1.8$ and $pK_{a_2} = 9.1$. What will be the pH at isoelectric point?
(a) 4.5 (b) 5.45 (c) 7 (d) 4.2

12. The formula of lysine is $H_2N(CH_2)_3 \cdot CH_2-\underset{NH_2}{CH}-COOH$ for lysine the value of pK_{a_1}, pK_{a_2} and pK_{a_3} are 2.2, 9.0 and 10.5 respectively. The pH at isoelectric point of lysine is
(a) 5.6 (b) 7 (c) 6.35 (d) 9.75

13. The dicationic form of the lysine is shown as



Arrange the shown hydrogen in the order of their acidic strength

(a) a > b > c (b) c > b > a (c) a > b = c (d) b = c > a

Passage 2

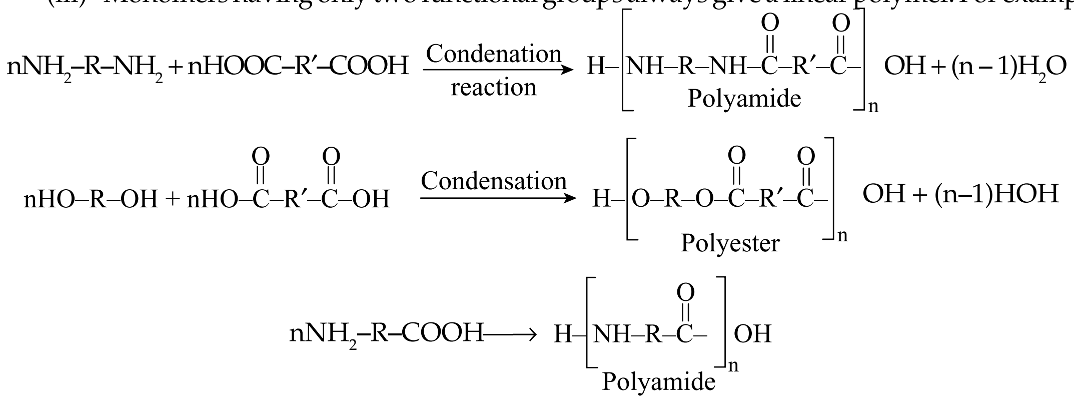
Classification of Polymers

(A) Condensation polymers and condensation polymerisation:

(i) Condensation polymerisation is also known as step polymerisation.

(ii) For condensation polymerisation, monomers should have at least two functional groups. Both functional groups may be same or different.

(iii) Monomers having only two functional groups always give a linear polymer. For example



(iv) Condensation polymers do not contain all the atoms initially present in the monomers. Some atoms are lost in the small molecule that is eliminated.

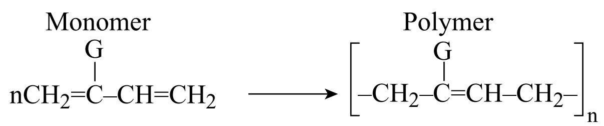
(v) Monomer having three functional groups always gives cross-linked polymer. Examples are: urea formaldelyde resin, phenol–formaldehyde resin, alkyde resin.

(B) Addition polymer:

(i) Polymers which are formed by addition reaction are known as addition polymers.

(ii) If monomer is ethylene or its derivative then addition polymer is either linear polymer or branch-chain polymer. Examples are: Polyethylene, polyvinylchloride, polystyrene polytetrafluoroethylene, polyvinyl cyanide, etc.

(iii) If monomer is 1,3-butadiene or 2-substituted-1,3 butadiene $\left(CH_2{=}\underset{\mid \atop G}{C}{-}CH{=}CH_2\right)$ then polymer is always branch chain polymer which is always an elastomer. Example are:



Monomer	Polymer
(i) G = H, 1,3-butadiene	(i) Polybutadiene
(ii) G = CH_3, 2-methyl-1,3-butadiene	(ii) Polyisoprene
(iii) G = Cl, 2-chloro-1, 3-butadiene or chloroprene	(iii) Polychloroisoprene (Neoprene)

(iv) Addition polymers retain all the atoms of the monomer units in the polymer.

(v) Addition polymerisation takes place in three steps: Initiation, chain propagation and chain termination.

(vi) Addition polymers are also known as chain growth polymers.

14. Which one of the following is a monomer of condensation polymer?
(a) $CH_3(CH_2)_5–COOH$ (b) $HO–CH_2–CH_2–OH$
(c) $CH_3–CH=CH–NH_2$ (d) $CH_3–CH=CH–CH_2–CONH_2$

15. Natural rubber is which type of polymer?
(a) Condensation (b) Addition (c) Coordinate (d) None of these

16. Among the following, identify the condensation polymer
(a) Nylon-6 (b) Buna-N (c) Polystyrene (d) Nylon-6-6

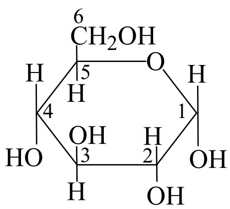
Passage 3

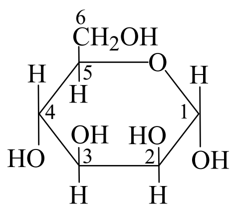
The carbohydrates in which the following properties are found are called reducing sugars.

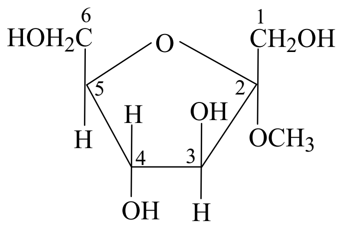
The reduction of Tollen's reagent, Fehling's solution, Benedict's solution.

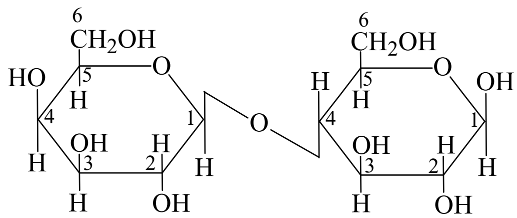
All monosaccharides are reducing sugars. Contrary to this the carbohydrates in which the above properties are not found are called non-reducing sugars. For example, sucrose, starch, cellulose, etc. The disaccharides, in which carbonyl group of any one monosaccharide from both the monosaccharides, is present as hemiacetal or ketal and does not involve in glycosidic linkage formation, are reducing. For example, maltose and lactose. Two diastereomeric monosaccharides are called epimers when their configuration differs only at stereogenic centre. Monosaccharides form glycoside with alcohol in the presence of an acid. All monosaccharides show mutarotation.

17. Which of the following is a non-reducing sugar?

(a) 

(b) 

(c) 

(d) 

18. Which one of the following is C-2 epimers?
(a) Glucose and galactose (b) Glucose and mannose
(c) Glucose and fructose (d) Galactose and fructose

19. Which of the following statements about lactose is not correct?
(a) It does not reduces Tollen's reagent
(b) It is a disaccharide. On hydrolysis, it produces two monosaccharides
(c) It possess glycosidic linkage
(d) All of them

Passage 4

Monosaccharides have —CHO (or C=O) and —OH groups, so they undergo usual oxidation and reduction. Further, monosaccharides form osazone when treated with excess of phenylhydrazine (3 equivalents). In osazone formation only the first two carbon atoms are involved. Thus

monosaccharides having identical configuration on rest of C atoms except first two will form same osazone. The same is the case with glucose and fructose.

A, B and C are three hexoses and form same osazone D. Compounds A to D behave as shown below:

(i) $D \xrightarrow{HCl} \xrightarrow[CH_3COOH]{Zn}$ D-Fructose

(ii) $A \xrightarrow{Ni, H_2} \xrightarrow{HNO_3} \xrightarrow[H_3O^+]{Na-Hg} B + C$

(iii) $B \xrightarrow{HNO_3}$ Optically active glyceric acid

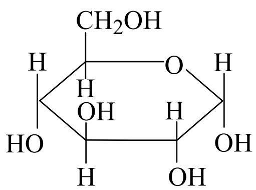
(iv) $C \xrightarrow{HNO_3}$ Optically active glyceric acid

20. Compound D is a osazone which can be obtained from
(a) Only one compound
(b) Two compounds
(c) Three compounds
(d) Four compounds

21. Compound A should be
(a) D-glucose
(b) D-fructose
(c) L-glucose
(d) L-fructose

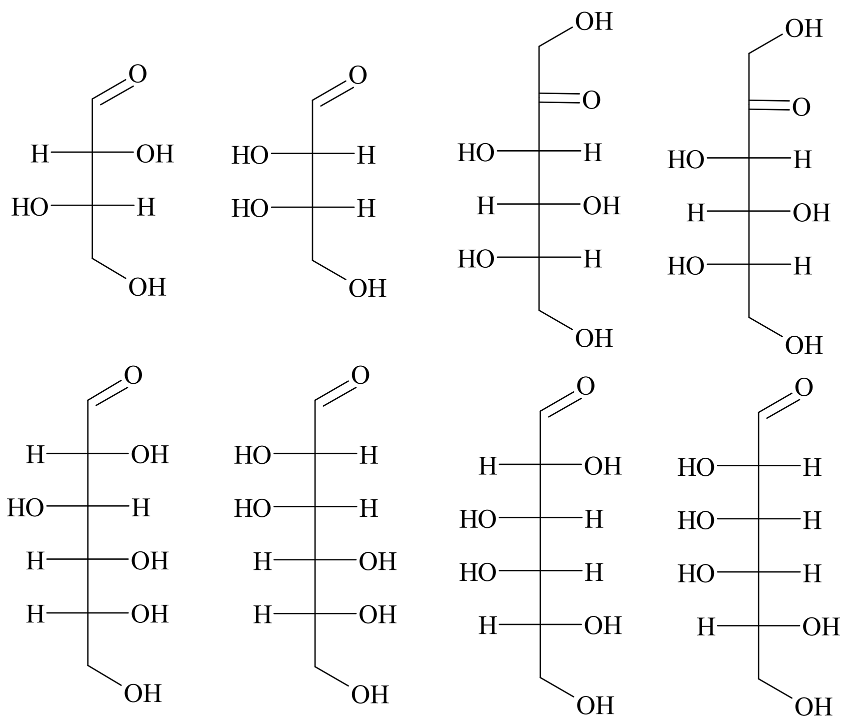
22. Compound B and C, respectively, are
(a) D-glucose and D-mannose
(b) D-mannose and D-glucose
(c) D-glucose and L-glucose
(d) D-glucose and L-mannose

Integer Type

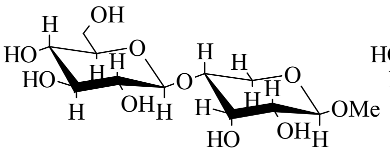
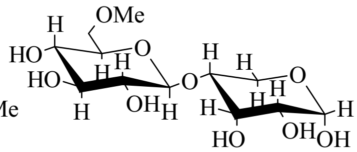
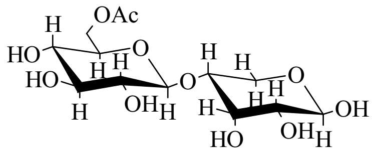
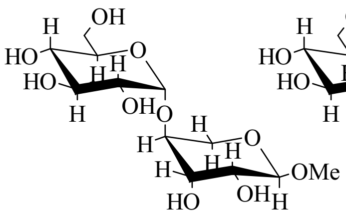
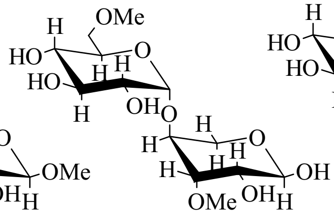
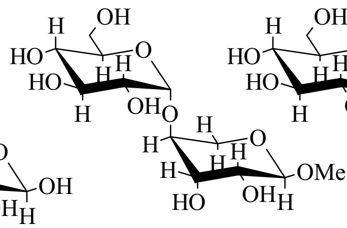
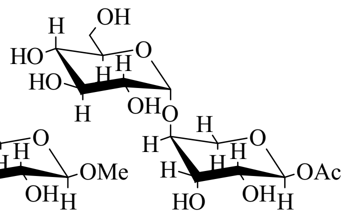
23. 

$\xrightarrow[H_2O]{Br_2}$ Compound (A) ; Number of chiral centre in compound A is

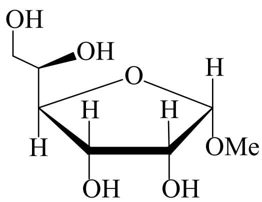
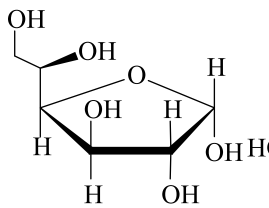
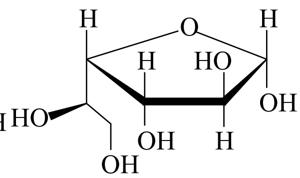
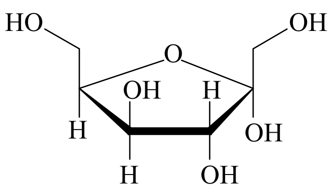
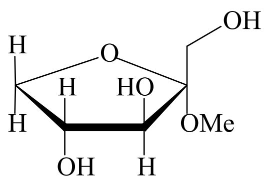
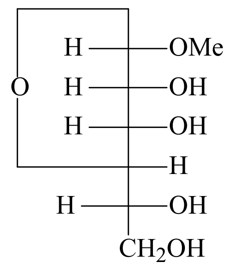
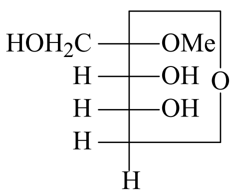
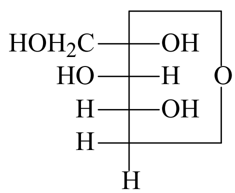
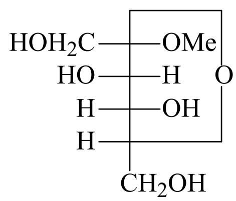
24. Identify the total number of carbohydrates which have D-configuration



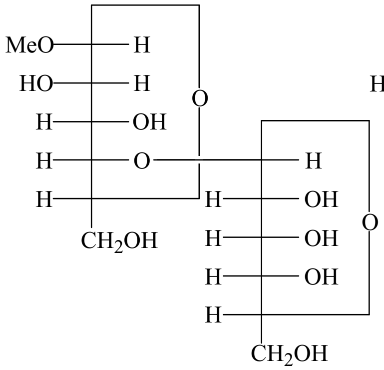
25. Identify the total number of carbohydrates which give mutarotation

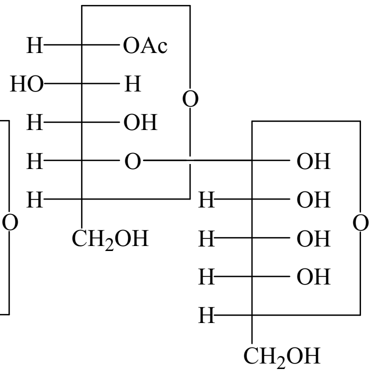








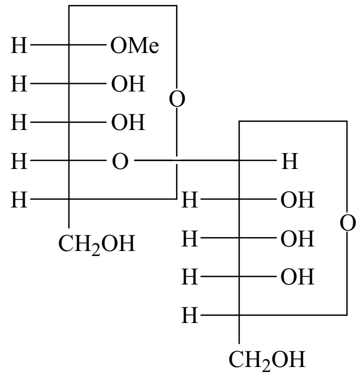
26. Identify the total number of carbohydrates which give mutarotation

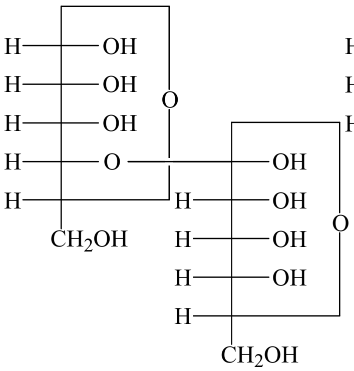










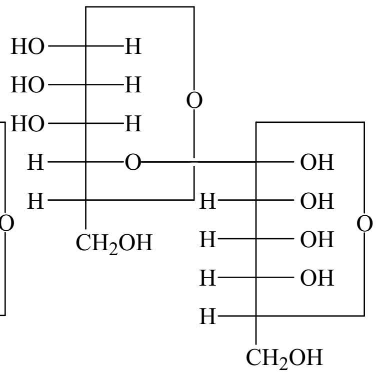
27. Identify total number of carbohydrates which give ⊕ve tollen test.

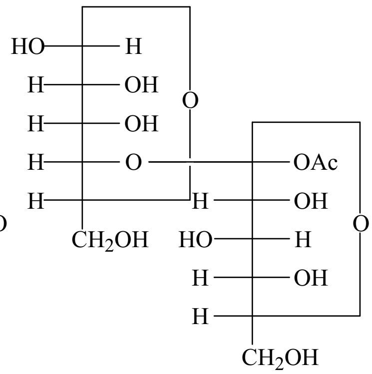












Answer Keys

LEVEL 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
d	b	d	c	a	b	d	c	c	d	b	d	a	a	c
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
ab	b	d	c	a	c	d	b	a	c	d	a	b	a	d
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
d	b	a	c	ad	d	c	c	c	ab	a	a	a	c	a
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
c	d	a	d	b	b	c	a	b	a	d	c	a	c	a
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
d	d	a	b	a	a	b	c	b	a	b	b, d	d	b	a
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
d	d	d	c	b	c	a	a	b	b	d	b	c	c	b
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
b	b	a	d	b	c	d	c	b	d	c	a	b	b	b
106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
d	ab	b	c	d	cd	d	b	b	c	d	c	b	d	a
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d	b	b	a	a	d	a	a	b	bd	c	d	c	b	d
136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
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151	152	153	154	155	156	157	158	159	160	161	162	163	164	165
d	a	a	c	c	c	a	b	b	d	b	c	d	d	b
166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
c	a	a	a	a	a	c	b	a	d	a	a	c	a	c
181	182	183	184	185	186	187	188	189	190	191	192	193		
a	b	a	c	b	abd	d	b	a	a	d	b	a		

LEVEL 2

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
bd	ab	ab	abc	ab	acd	abc	bcd	abd	cd	b	d	a	b	b
16	17	18	19	20	21	22	23	24	25	26	27			
ad	c	b	a	d	b	a	4	4	3	4	3			

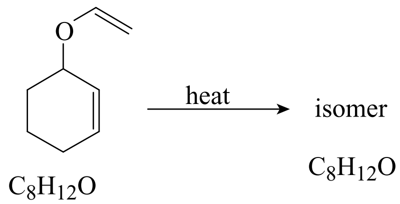
CHAPTER

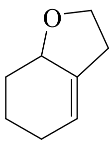
8 Organic Reaction Mechanisms and Reagents

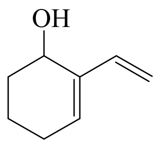
Question Bank

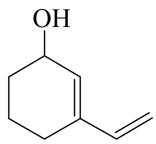
LEVEL 1

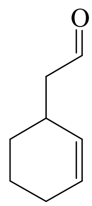
1. When the compound shown below is heated it undergoes a rearrangement to form an isomer. Identify the product.



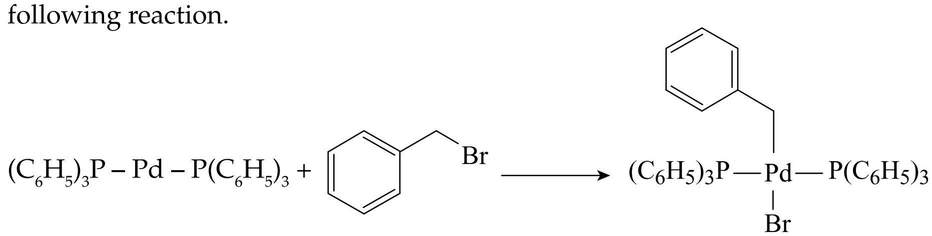
(a) 

(b) 

(c) 

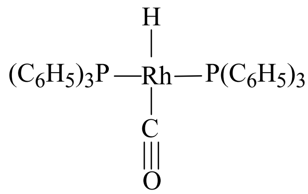
(d) 

2. Organometallic reactions can be classified into fundamental reaction types. Classify the following reaction.



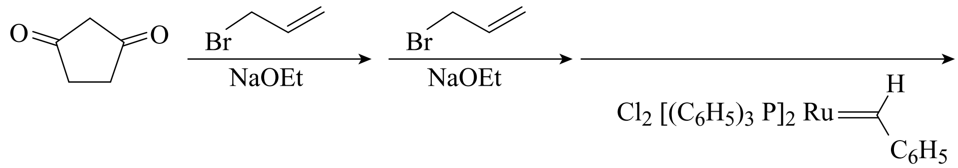
(a) Ligand insertion
(b) Ligand dissociation
(c) Reductive elimination
(d) Oxidative addition

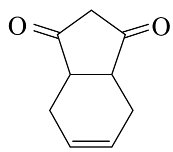
3. What is the electron count for the following transition metal complex?

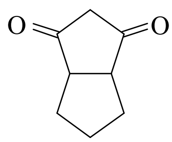


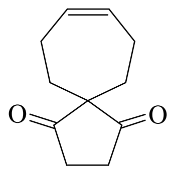
(a) 14 (b) 15 (c) 16 (d) 17

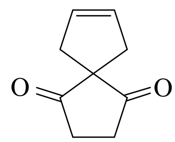
4. Predict the product of the following reaction sequence.



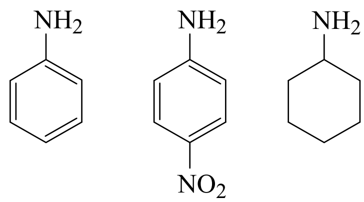
(a)


(b)


(c)


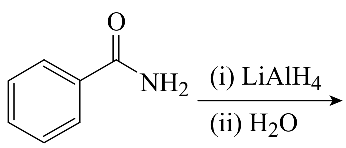
(d)


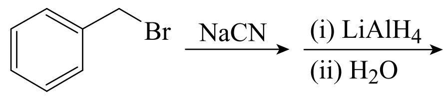
5. Consider the relative basicity of these three amines. Which statement is true?

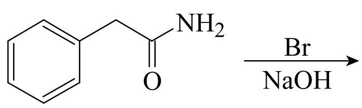


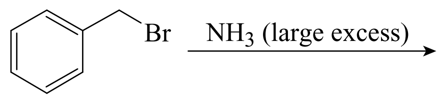
(a) Cyclohexylamine is the strongest base and aniline is the weakest base
(b) Cyclohexylamine is the strongest base and 4-nitroaniline is the weakest base
(c) Aniline is the strongest base and cyclohexylamine is the weakest base
(d) Nitroaniline is the strongest base and cyclohexylamine is the weakest base

6. Which of the following syntheses of benzylamine is the least likely to work?

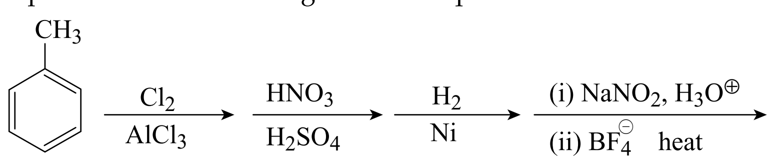
(a)


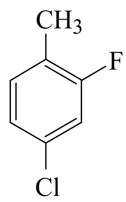
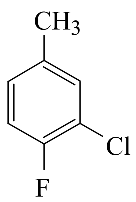
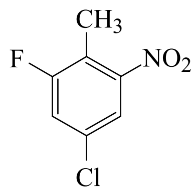
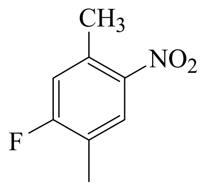
(b)


(c)


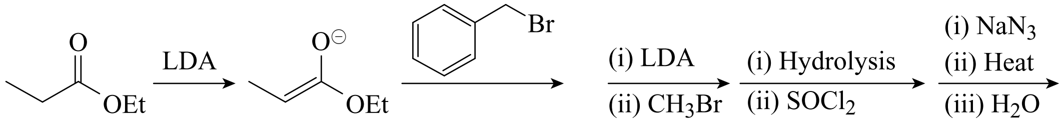
(d)


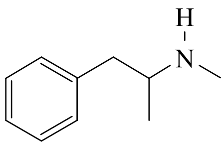
7. Predict the product of the following reaction sequence.

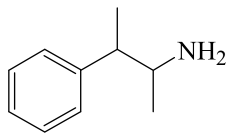


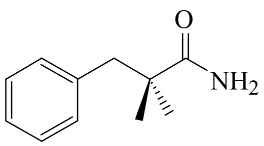
(a)  (b)  (c)  (d) 

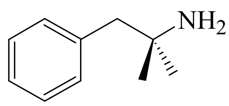
8. Predict the product of following reaction sequence.



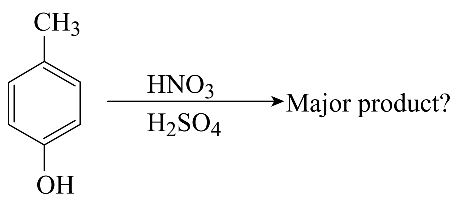
(a) 

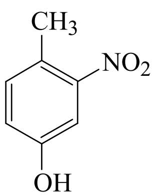
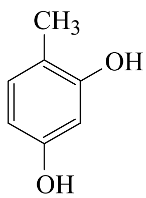
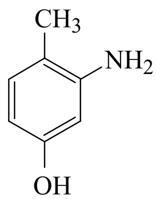
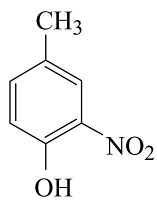
(b) 

(c) 

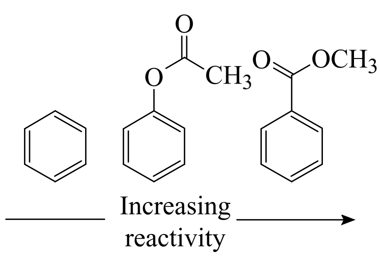
(d) 

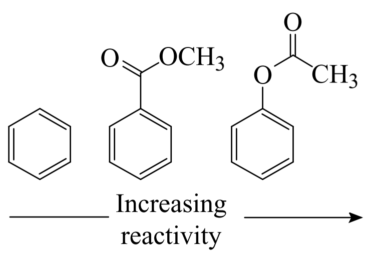
9. Choose the major product of the following reaction.

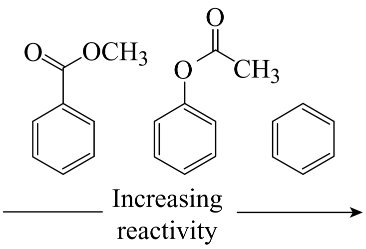


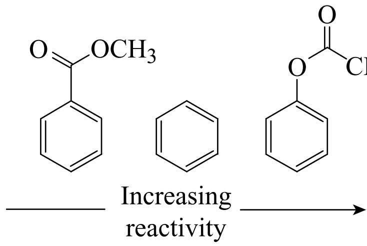
(a)  (b)  (c)  (d) 

10. Choose the answer that has the following compounds arranged correctly with respect to increasing reactivity with $Br_2/FeBr_3$.

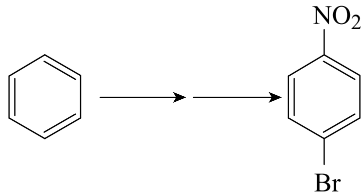
(a) 

(b) 

(c) 

(d) 

11. Choose the reaction sequence that could be used to perform the following transformation.



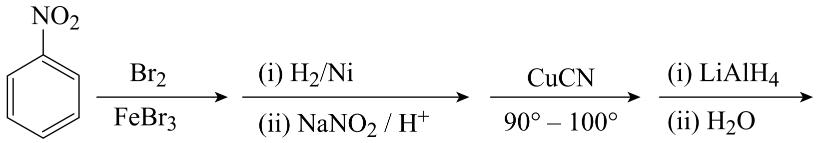
(a) $\xrightarrow[H_2SO_4]{HNO_3}$ $\xrightarrow[FeBr_3]{Br_2}$

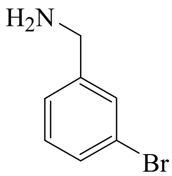
(b) $\xrightarrow[H_2SO_4]{HNO_3}$ $\xrightarrow{NBS}$

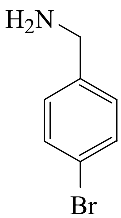
(c) $\xrightarrow[HCl]{NaNO_2}$ $\xrightarrow[FeBr_3]{Br_2}$

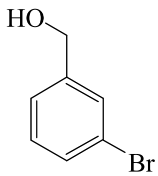
(d) $\xrightarrow[FeBr_3]{Br_2}$ $\xrightarrow[H_2SO_4]{HNO_3}$

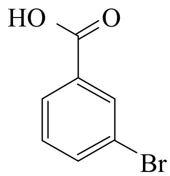
12. Predict the major product of the following reaction



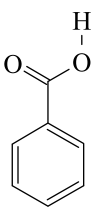
(a) 

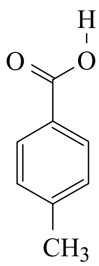
(b) 

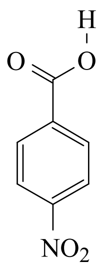
(c) 

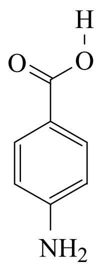
(d) 

13. Which of the following compounds is the most acidic? (lowest pK_a)

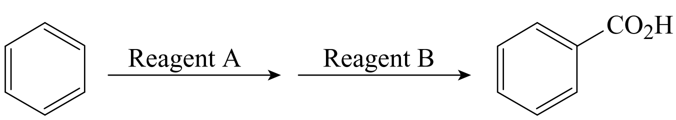
(a) 

(b) 

(c) 

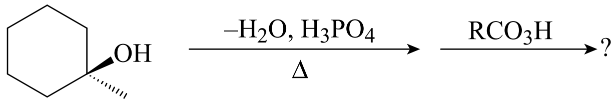
(d) 

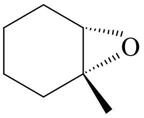
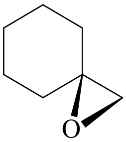
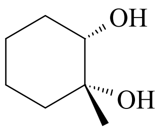
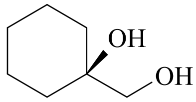
14. What could be reagents A and B for the following reactions?



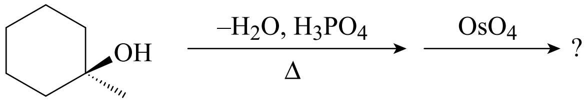
(a) Reagent A: CH_3CH_2Cl / $AlCl_3$; reagent B: $Na_2Cr_2O_7$, heat
(b) Reagent A: CH_3COCl / $AlCl_3$; reagent B: $Na_2Cr_2O_7$, heat
(c) Reagent A: HNO_3, H_2SO_4; reagent B: RCO_3H, heat
(d) Reagent A: CH_3COCl / $AlCl_3$; reagent B: H_2, Ni, heat

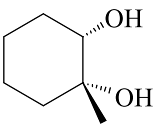
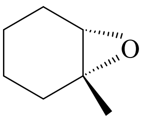
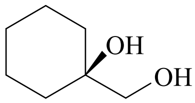
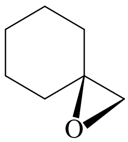
15. What could be the major product from the following reactions?



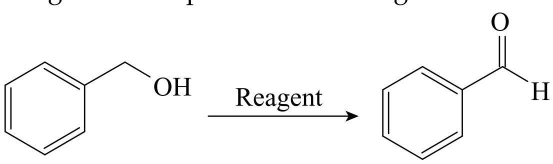
(a)  (b)  (c)  (d) 

16. What could be the major product from the following reactions?



(a)  (b)  (c)  (d) 

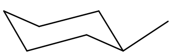
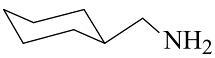
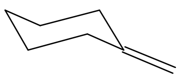
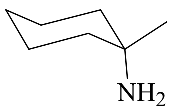
17. What could be the reagent to complete the following reaction?



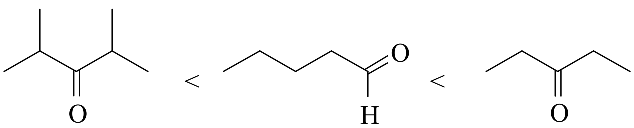
(a) $K_2Cr_2O_7$
(b) PCC in dried CH_2Cl_2
(c) H_2CrO_4
(d) OsO_4

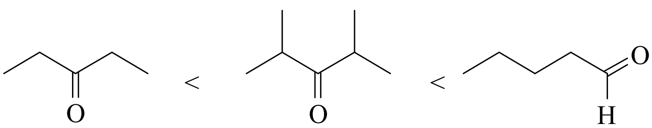
18. What could be the major product for the following reaction?

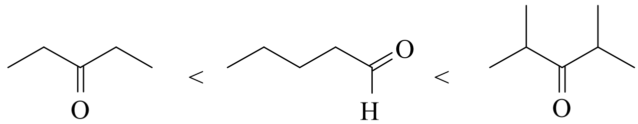


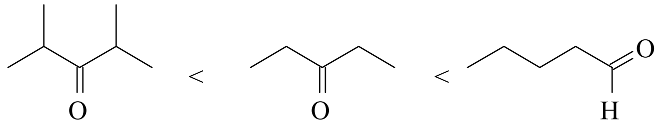
(a)  (b)  (c)  (d) 

19. Choose order that has the following compounds correctly arranged with respect to increasing rate of reaction with $LiAlH_4$ (most reactive compound on the right).

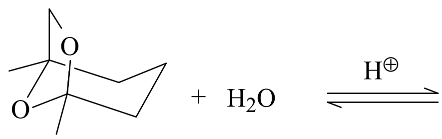
(a) 

(b) 

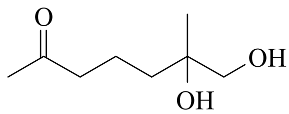
(c) 

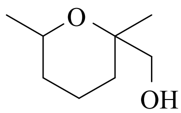
(d) 

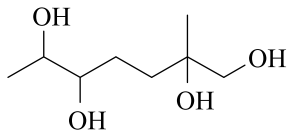
20. Choose the following compound that will cyclize to give the pheromone frontalin.

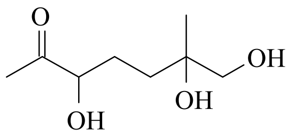


Frontalin

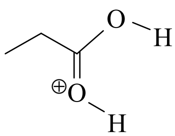
(a) 

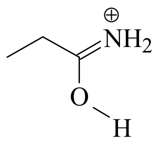
(b) 

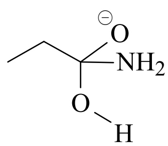
(c) 

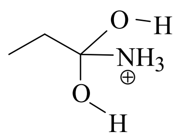
(d) 

21. Choose the species that does not represent an intermediate in the acid-catalyzed hydrolysis of propionamide to carboxylic acid.

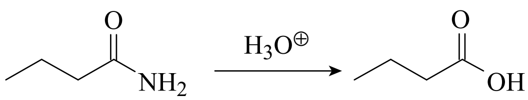
(a) 

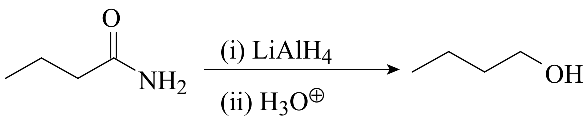
(b) 

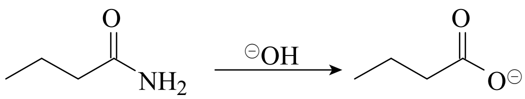
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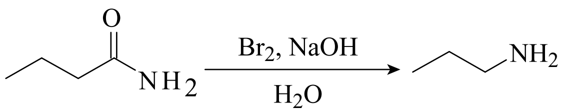
(d) 

22. Choose the reaction(s) that will not proceed as shown hereunder.

(i) 

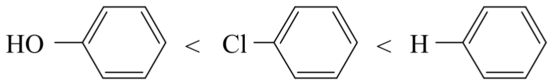
(ii) 

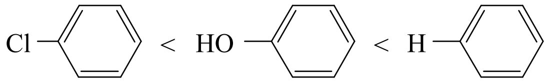
(iii) 

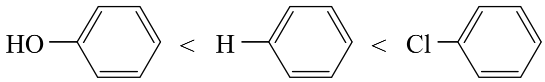
(iv) 

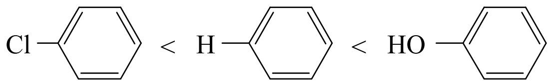
(a) Only i (b) Only ii (c) Only iii (d) Only iv

23. Choose the order that has the following aromatic compounds correctly arranged with respect to increasing reactivity towards $Br_2/FeBr_3$

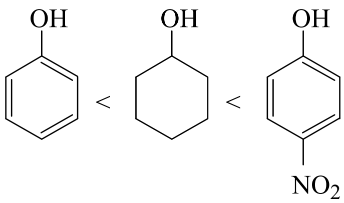
(a) 

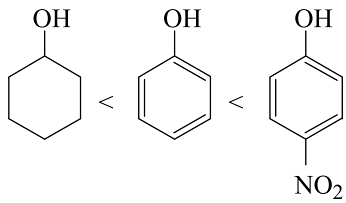
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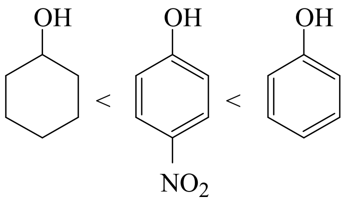
(c) 

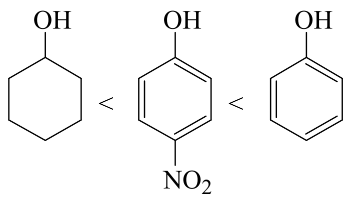
(d) 

24. Choose the order that has the following alcohols correctly arranged with respect to increasing acidity.

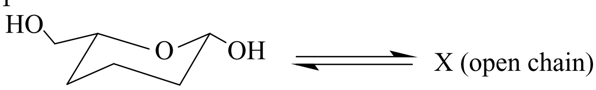
(a) 

(b) 

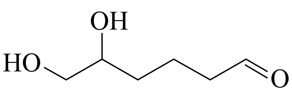
(c) 

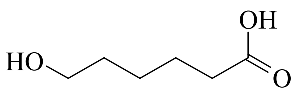
(d) 

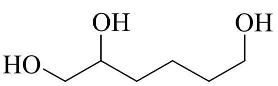
25. The compound shown below is a cyclic hemiacetal. It is in equilibrium with an acyclic open chain compound X.

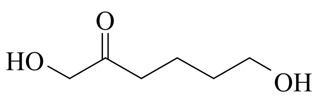


Identify the structure of compound X.

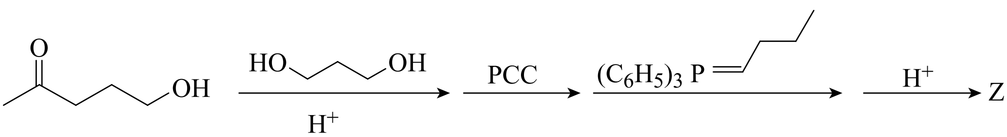
(a) 

(b) 

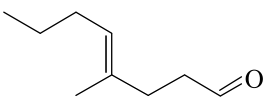
(c) 

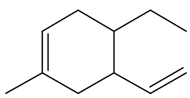
(d) 

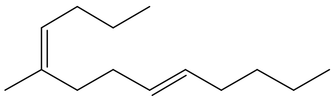
26. The reaction sequence shown below gives compound Z as the main product.

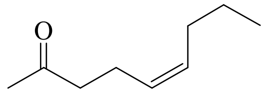


Identify the structure of compound Z.

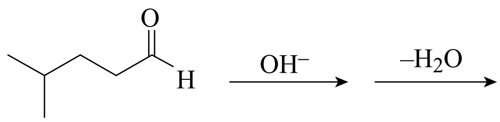
(a) 

(b) 

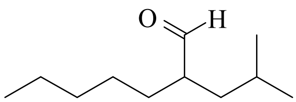
(c) 

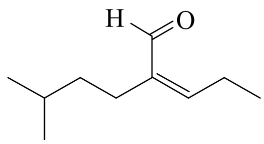
(d) 

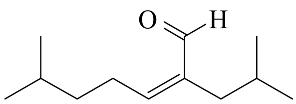
27. Predict the product of the following aldol condensation.

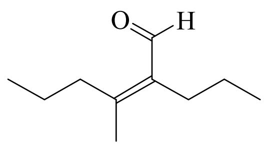


2 moles

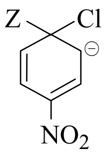
(a) 

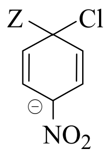
(b) 

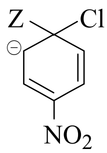
(c) 

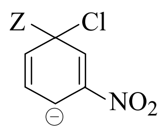
(d) 

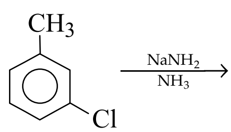
28. Which of the following structure is more stable?

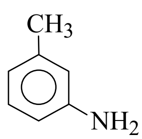
(a) 

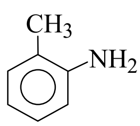
(b) 

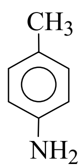
(c) 

(d) 

29. Predict the nature of P in the following reaction  P (Major product)

(a) 

(b) 

(c) 

(d) All the three

30. Which of the following is most reactive towards aqueous HBr?

(a) 1-Phenyl-2-propanol

(b) 1-Phenyl-1-propanol

(c) 3-Phenyl-1-propanol

(d) 2-Phenyl-1-propanol

31. Ethylbenzene when treated with chlorine in presence of light mainly gives

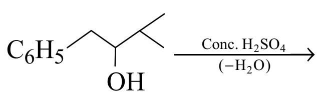
(a) β-phenylethyl chloride

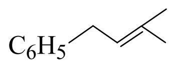
(b) α-phenylethyl chloride

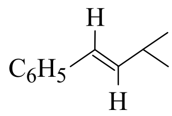
(c) o-chloroethyl benzene

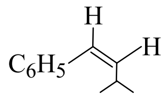
(d) o-and p-chloroethylbenzene

32. The following alcohol is treated with Conc. H_2SO_4, the major product obtained is

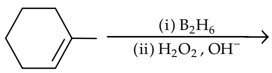


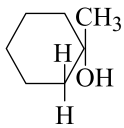
(a) 

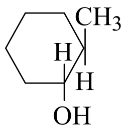
(b) 

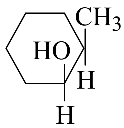
(c) 

(d) All the three will be formed in equal amounts

33.  X. The compound X is

(a) 

(b) 

(c) 

(d) Both (b) and (c)

34. Give the nature of A and B in the given reaction

$$B \xleftarrow[H^+]{KMnO_4} (CH_3)_3COH \xrightarrow{KMnO_4/OH^-} A$$

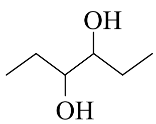
(a) A and B both are $(CH_3)_2C=CH_2$

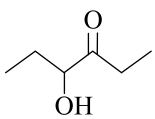
(b) A and B, both are $(CH_3)_2CO + CH_2O$

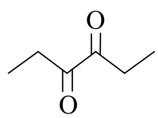
(c) A is $(CH_3)_3COH$, while B is $(CH_3)_2C=CH_2$ or $(CH_3)_2CO$

(d) A and B, both are $(CH_3)_3COH$, i.e., there is no reaction

35. Which of the following is liable to be oxidized by periodic acid?

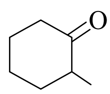
(a) 

(b) 

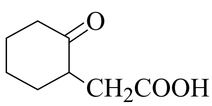
(c) 

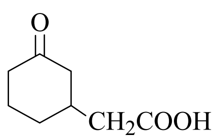
(d) All of these

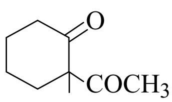
36. From the given set of reaction

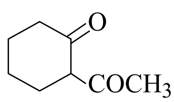
$$A \xrightarrow[(ii)\ H^+]{(i)\ NaOI} [B] \xrightarrow{Heat}$$ 

starting compound A corresponds to

(a) 

(b) 

(c) 

(d) 

37. Methanoic acid is heated with Conc. H_2SO_4, to form

(a) CO (b) CO_2 (c) CH_4 (d) $(COOH)_2$

38. When ethane-1,2-dioic acid is heated with Conc. H_2SO_4, it gives

(a) CO + HCOOH

(b) CO_2 + HCOOH

(c) CO + CO_2 + HCOOH

(d) CO + CO_2 + H_2O

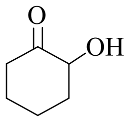
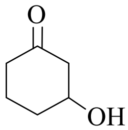
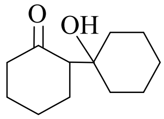
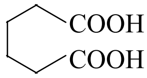
39. When sodium formate is heated with soda lime, we get

(a) CH_4 (b) H_2 (c) sodium oxalate (d) no action

40. Sodium formate is heated at 360°C to give

(a) CO (b) CO_2 (c) sodium oxalate (d) no action

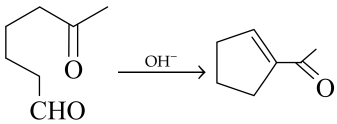
41. When cyclohexanone is treated with Na_2CO_3 solution, we get

(a)  (b)  (c)  (d) 

42. Which of the following reagent reacts in different ways with CH_3CHO, HCHO and C_6H_5CHO?

(a) Fehling's solution (b) $C_6H_5NHNH_2$

(c) Ammonia (d) HCl

43. The reaction  is an example of

(a) Oxidation reaction (b) Reduction

(c) Both (d) Aldol condensation

44. $C_6H_5\overset{OH}{\overset{|}{C}}H{-}\overset{O}{\overset{||}{C}}{-}C_6H_5 \xrightarrow[HCl]{Zn/Hg}$ P. Here, P should be

(a) $C_6H_5\overset{OH}{\overset{|}{C}}H\;\overset{OH}{\overset{|}{C}}HC_6H_5$ (b) $C_6H_5\overset{OH}{\overset{|}{C}}HCH_2C_6H_5$

(c) $C_6H_5CH_2CH_2C_6H_5$ (d) $C_6H_5CH=CHC_6H_5$

45. Nitrobenzene can be reduced to aniline by

(i) H_2/Ni (ii) Sn/HCl (iii) Zn/NaOH (iv) $LiAlH_4$

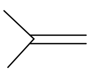
(a) i, ii and iii (b) i and ii (c) i, ii and iv (d) only ii

46. 1-Methylcyclopentene can be converted into 2-methylcyclopentanol by

(a) acid-catalyzed hydration
(b) hydroboration oxidation
(c) epoxide formation followed by reduction with $LiAlH_4$
(d) oxymercuration-demercuration

47. 2-Methylpropanol-2 can be obtained by the acid-catalyzed hydration of

(a) $CH_3CH_2CH=CH_2$ (b) $CH_3CH=CHCH_3$

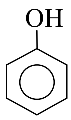
(c)  (d) Either of the three

48. Predict the nature of P in the following reaction $CH_3C\equiv CCH_3 \xrightarrow[heat]{NaNH_2/\text{inert solvent}} P$

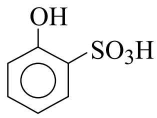
(a) $CH_2{=}CHCH{=}CH_2$ (b) $CH_2{=}C{=}CH{-}CH_3$

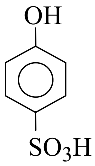
(c) $CH_3CH_2C\equiv CH$ (d) No reaction

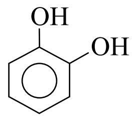
49. Identify the nature of product in the following reaction

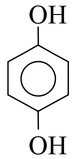


$+ K_2S_2O_8 \xrightarrow[H_2O]{HO^-}$ Product

(a) 

(b) 

(c) 

(d) 

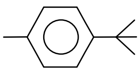
50. Arrange the following alcohols in order of increasing ease of dehydration

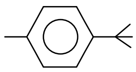
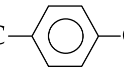
(i) CH_3CH_2OH (ii) $C_6H_5CH_2OH$ (iii) Cl_3CCH_2OH (iv) F_3CCH_2OH

(a) ii < i < iv < iii (b) iv < iii < ii < i
(c) iv < iii < i < ii (d) ii < i < iii < iv

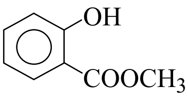
51. 1,2-Diethylbenzene on ozonolysis gives..........different products

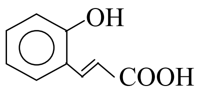
(a) 1 (b) 2 (c) 3 (d) 4

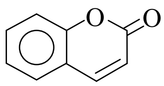
52.  $\xrightarrow{K_2Cr_2O_7 + H_2SO_4}$ Z. Here, Z is

(a) HOOC 
(b) $(CH_3)_3CCOOH$
(c) Both (a) and (b)
(d) HOOC  COOH

53. When o-hydroxybenzaldehyde is heated with ethanoic anhydride in the presence of sodium ethanoate, compound formed during the reaction is

(a) 

(b) 

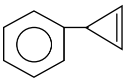
(c) 

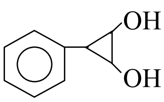
(d) Both (b) and (c)

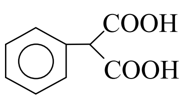
54. A new carbon–carbon bond is formed in

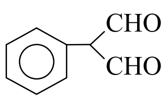
(i) Aldol condensation (ii) Kolbe's reaction
(iii) Reimer-Tiemann reaction (iv) Wurtz Fittig reaction

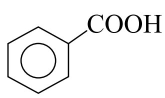
(a) i, iii (b) ii, iii (c) i, iii, iv (d) All of these

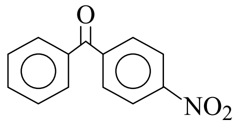
55.  $\xrightarrow[\text{(ii) } HIO_4]{\text{(i) alk. } KMnO_4}$ P. The compound P should be

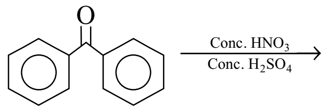
(a) 

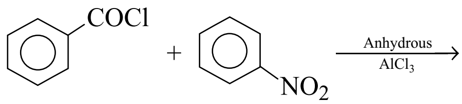
(b) 

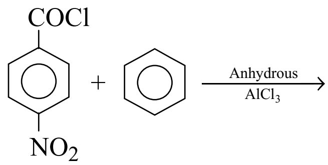
(c) 

(d) 

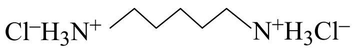
56. Which are the starting materials for the preparation of 

(a) 

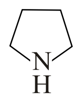
(b) 

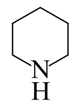
(c) 

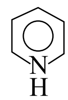
(d) Any of the three

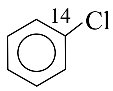
57.  $\xrightarrow{\text{Heat}}$ Z ; Z is

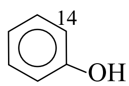
(a) 

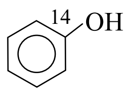
(b) 

(c) 

(d) 

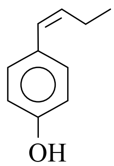
58.  + NaOH(aq.) $\xrightarrow{400°C}$ Product is

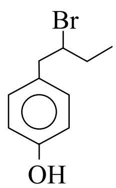
(a) 

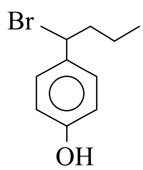
(b) 

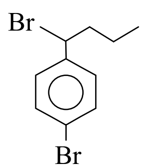
(c) Both (a) and (b)

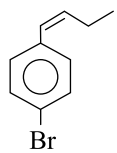
(d) No reaction

59.  + HBr ⟶ Z, Z is

(a) 

(b) 

(c) 

(d) 

60. $Me_2CHOCMe_3 \xrightarrow{HI} X + Y$

Predict the nature of product and the type of reaction involved in their formation.

(a) Me_2CHI and Me_3COH, formed by S_N1 reaction

(b) Me_2CHI and Me_3CI, formed by S_N1 reaction

(c) Me_2CHI and Me_3COH, formed by S_N2 reaction

(d) Me_2CHOH and Me_3CI, formed by S_N2 reaction

61. Anisole is treated with HI under two different conditions

$C + D \xleftarrow{HI(g)} C_6H_5OCH_3 \xrightarrow{\text{Conc. HI}} A + B$

The nature of A to D will be

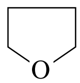
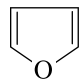
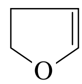
(a) A and B are CH_3I and C_6H_5OH, while C and D are CH_3OH and C_6H_5I

(b) A and B are CH_3OH and C_6H_5I, while C and D are CH_3I and C_6H_5OH

(c) Both A and B as well as both C and D are CH_3I and C_6H_5OH

(d) A and B are CH_3I and C_6H_5OH, while there is no reaction in the second case.

62. Arrange the following in decreasing order of solubility in water

(i)  (ii)  (iii) 

(a) i > iii > ii (b) iii > ii > i (c) ii > iii > i (d) All are equally soluble

63. The ethereal linkage (–C–O–C–) is cleaved by

(a) HBr (b) HNO_3 (c) Both (a) and (b) (d) None

64. Predict the compounds A and B in the following reactions

$$CH_3CH_2–O–CH_2CH_3 + O_2 \xrightarrow{h\nu} A; \quad C_6H_5CH(CH_3)_2 \xrightarrow{O_2,\ 95-135°} B$$

(a) $CH_3CH_2–O–O–CH_2CH_3$ and $C_6H_5-C(CH_3)_2-O-OH$ respectively

(b) $CH_3CH_2–O–O–CH_2CH_3$ and $C_6H_5-CH(CH_3)-CH_2-O-OH$ respectively

(c) $CH_3CH(OOH)-O-CH_2CH_3$ and $C_6H_5-C(CH_3)_2-O-OH$ respectively

(d) No reaction and $C_6H_5-C(CH_3)_2-O-OH$ respectively

65. Products (P_2) $\xleftarrow{\text{anhy. HI}}$ $(CH_3)_3C–O–CH_3$ $\xrightarrow{\text{Conc. HI}}$ Products (P_1)

The products P_1 and P_2 respectively are

(a) $(CH_3)_3COH + CH_3I$ and $(CH_3)_3CI + CH_3OH$

(b) $(CH_3)_3CI + CH_3OH$ and $(CH_3)_3COH + CH_3I$

(c) $(CH_3)_3CI + CH_3OH$ in both cases

(d) CH_3I and $(CH_3)_3COH$ in both cases

66. Cyclobutylethene is treated with dil. H_2SO_4 to form

(a) 2-cyclobutylethanol (b) 1-cyclobutyl-2-ethanol

(c) 2-methylcyclopentanol (d) 1-methylcyclopentanol

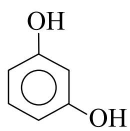
67. The decreasing order of acidic character of the compounds is
$CH_3C\equiv CH$, MeOH, Me_2CHOH, Me_3COH, H_2O
(a) $CH_3C\equiv CH > Me_3COH > Me_2CHOH > MeOH > H_2O$
(b) $MeOH > Me_2CHOH > Me_3COH > H_2O > CH_3C\equiv CH$
(c) $Me_3COH > Me_2CHOH > MeOH > H_2O > CH_3C\equiv CH$
(d) $MeOH > H_2O > Me_2CHOH > Me_3COH > CH_3C\equiv CH$

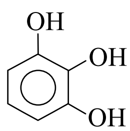
68. Arrange the following in the decreasing order of acidic strength
(i) Phenol (ii) p-nitrophenol (iii) m-cresol (iv) p-cresol
(a) ii > iii > iv > i
(b) ii > i > iii > iv
(c) ii > i > iv > iii
(d) iii > iv > ii > i

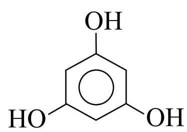
69. Which of the following will be most acidic
(a) o-Aminophenol
(b) p-Aminophenol
(c) m-Aminophenol
(d) None of these

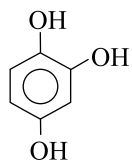
70. Arrange the following in increasing acidic character
(i) Phenol
(ii) m-nitrophenol
(iii) m-chlorophenol
(iv) m-cresol
(a) iv < i < iii < ii
(b) iv < i < ii < iii
(c) i < iv < iii < ii
(d) iii < ii < iv < i

71. Which of the following compounds can react with hydroxylamine?

(a) 

(b) 

(c) 

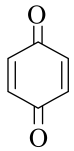
(d) 

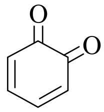
72. Which of the following statement is true regarding amount of $AlCl_3$ required during Friedel-Craft acetylation using acetyl chloride or acetic anhydride?
(a) Both require same amount
(b) Acetylation with acetyl chloride requires more amount
(c) Acetylation with acetic anhydride requires more amount
(d) Nothing is definite

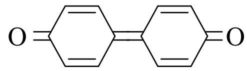
73. Which of the following gives effervescenes of CO_2 with $NaHCO_3$ solution?
(a) HCOOH
(b) 2,4,6-trinitrophenol
(c) Both (a) and (b)
(d) None of these

74. 2,4,6-Trinitrophenol can be prepared in good yield
(a) by the nitration of 2,4-dinitrochlorobenzene
(b) by the nitration of 2,4-dinitrophenol
(c) by both (a) and (b)
(d) neither by (a) nor by (b)

75. The correct stability order of the following three quinones is

(i) 

(ii) 

(iii) 

(a) i > iii > ii
(b) i = iii > ii
(c) i = ii > iii
(d) iii > i > ii

76. Which of the following is most stable, and which one is least stable?

(i) HCHO (ii) CH_3CHO (iii) CH_3COCH_3 (iv) Cl_3CCHO

(a) (iii) is most stable and (i) is least
(b) (iv) is most stable and (i) is least
(c) (iii) is most stable and (iv) is least
(d) All the four are equally stable

77. Which of the following has highest and lowest hydration equilibrium constant?

HCHO, CH_3CHO, CH_3COCH_3

(a) HCHO-Highest, CH_3CHO-Lowest
(b) CH_3CHO-Highest, HCHO-Lowest
(c) HCHO-Highest, CH_3COCH_3-Lowest
(d) CH_3COCH_3-Highest, HCHO-Lowest

78. $CH_3COCH_2Cl \xrightarrow{OH^-,\ Cl_2}$ Product P is

(a) $ClCH_2COCH_2Cl$
(b) $CH_3COCHCl_2$
(c) Both (a) and (b)
(d) $ClCH_2COOH + CH_3Cl$

79. Which of the following is an example of nucleophilic addition?

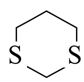
(a) $C_6H_5C(=O)CH_3 \xrightarrow{NH_2NH_2,\ H^+} C_6H_5C(=NNH_2)CH_3$

(b) $C_6H_5C(=O)CH_3 \xrightarrow{LiAlH_4} C_6H_5CH(OH)CH_3$

(c) Both (a) and (b)
(d) None of the two

80. Propanal and propanone, both have same molecular formula (C_3H_6O), what do you expect about their boiling points?

(a) Both have same boiling point.
(b) Boiling point of propanal is higher than the boiling point of propanone.
(c) Boiling point of propanal is lower than the boiling point of propanone.
(d) Nothing can be predicted.

81. Which of the following statement is false about 1,3-dithane,  ?

(a) 1,3-Dithane can react with RLi
(b) It can be alkylated by $CH_3CH_2CH_2Br$

(c) It can be alkylated by Me_2CHX

(d) 1,3-Dithane can be used for preparing aldehydes and ketones

82. In dilute aqueous solution, formaldehyde exists as

(a) Formaldehyde (b) Paraldehyde (c) Trioxymethylene (d) Methyleneglycol

83. The major driving force for the hydration of chloral is

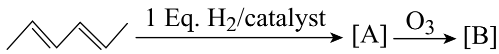
(a) less steric hinderance in the product

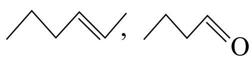
(b) less force of repulsion in the product

(c) hydrogen bonding in the product

(d) electronegativity of the three chlorine atoms

84. The products A and B in the following reactions are



(a) 

(b) 

(c) Both (a) and (b)

(d) 

85. $CH_3\overset{O}{\overset{||}{C}}C_2H_5 + NaCN + NH_4Cl \xrightarrow{NH_4OH} Z$; Z is

(a) $(CH_3)(C_2H_5)C(OH)(COOH)$ (b) $(CH_3)(C_2H_5)C(OH)(CN)$ (c) $(CH_3)(C_2H_5)C(NH_2)(CN)$ (d) $(CH_3)(C_2H_5)C(CN)(COOH)$

86. The compound having the formula, $CH_3-\overset{O}{\overset{||}{C}}-CH_2-\overset{O}{\overset{||}{C}}-OC_2H_5$

(a) forms dioxime

(b) undergoes iodoform test

(c) both (a) and (b)

(d) neither of the two

87. Fehling's solution can be used for distinguishing between

(a) CH_3CHO and C_6H_5CHO

(b) CH_3CHO and CH_3COCH_2OH

(c) Both (a) and (b)

(d) None of these

88. Which of the following is least reactive with a nucleophile?

(a) Methanal (b) Propanone (c) 3-Pentanone (d) 2-Pentanone

89. Aldehydic group can be protected

(a) by acetal formation against alkaline oxidizing agents.

(b) by mercaptal formation against acidic oxidizing agents.

(c) both (a) and (b)

(d) none of the above

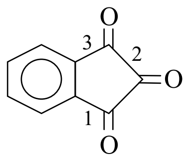
90. $2\begin{array}{l}CHO\\|\\COOH\end{array} \xrightarrow{OH} \begin{array}{l}COO^-\\|\\CH_2OH^+\end{array} \begin{array}{l}COO^-\\|\\COO^-\end{array}$

The above reaction can said to be an example of

(a) Intramolecular Cannizzaro reaction (b) Intermolecular Cannizzaro reaction

(c) Crossed Cannizzaro reaction (d) Tischenko reaction

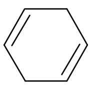
91. Ninhydrin has three keto groups, which of the keto group is expected to be hydrated most easily?



(a) 2 (b) 3 (c) 1 (d) All are equally hydrated

92. $C_2H_5O-\overset{\overset{O}{\|}}{C}-OC_2H_5 + 2CH_3MgBr \longrightarrow A$; A is

(a) $(CH_3)_2\overset{\overset{OH}{|}}{C}-C_2H_5$ (b) $C_2H_5\underset{\underset{C_2H_5}{|}}{\overset{\overset{OH}{|}}{C}}-CH_3$ (c) CH_3COOH (d) CH_3COCH_3

93.  $\xrightarrow[\text{(ii) Heat}]{\text{(i) } O_3 / H_2O}$ A; A is

(a) $CH_2(COOH)_2$ (b) CH_3COOH (c) HCOOH (d) HCHO

94. Which is least reactive towards addition of HCl?

(a) $CH_3CH_2CH=CH_2$ (b) $CH_2=CH-CH=CH_2$

(c) $CH_3CH_2C\equiv CCH_3$ (d) $CH_3CH=CHCHO$

95. Which of the following is true regarding preparation of aldehydes and ketones?

(i) Both can be prepared by the oxidation of the concerned alcohol with copper at about 250ºC.

(ii) Both can be prepared by the oxidation of the concerned alcohol by Oppenauer oxidation.

(iii) Both can be prepared by the oxidation of respective alcohol with acidic dichromate.

(a) i (b) ii and iii (c) i and iii (d) All the three

96. Observe the following structures and pick up the correct statement.

(i) $>C=O$ (ii) $>C=\overset{+}{O}H$

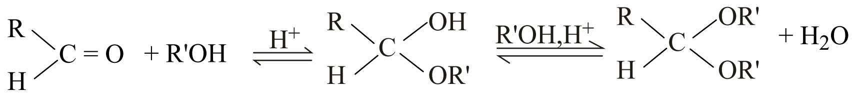
(a) Carbonyl carbon of (i) is more electrophilic than that of (ii).

(b) Carbonyl carbon of (i) is less electrophilic than that of (ii).

(c) Carbonyl carbon of both structures has equal electrophilic character.

(d) It depends upon the complete structure of the compound

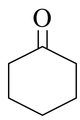
97. Acetal formation is a reversible reaction

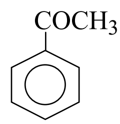


Under what conditions, the reaction can be forced to proceed only in right (forward) direction?

(a) Using excess of alcohol
(b) Using high temperature
(c) Using dilute acid and excess of alcohol
(d) Using dry acid and excess of alcohol

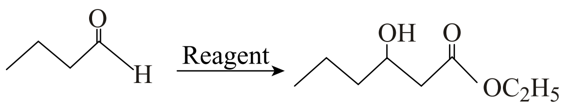
98. Which of the following does not react with sodium bisulphite?

(i) HCHO (ii) $CH_3COC_2H_5$ (iii) 

(iv) 

(a) iii and iv (b) ii and iv (c) i (d) All reacts

99. Which of the following reagent can be used for carrying out the reaction outlined below?



(a) $BrMgCH_2COOC_2H_5$ (b) $BrZnCH_2COOC_2H_5$
(c) $LiCH_2COOC_2H_5$ (d) Any of the three

100. Which of the following statement is false?

(a) Cannizzaro reaction is given by aldehydes in presence of alkali
(b) Aldol condensation is given by aldehydes in presence of alkali
(c) Aldol condensation is given by aldehydes and ketones in presence of acids
(d) None of these

101. Carbonyl compounds, sensitive to both acids as well as bases, can be reduced to hydrocarbons by

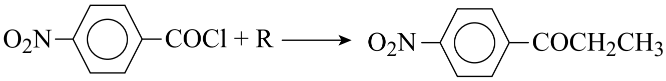
(a) Clemmensen reduction (b) Wolf-Kishner reduction
(c) Thioacetal reduction (d) All of the three

102. What should be the product when ethylmethyl ketone is treated with peracetic acid

(a) Ethyl acetate (b) Methyl propanoate
(c) Both (a) and (b) (d) Only acetic acid

103. Which of the following complex hydride is a stronger reducing agent?

(a) $Li^+[AlH_4]^-$ (b) $Li^+[Al(OCMe_3)_3H]^-$
(c) $Al(CH_2CHMe_2)_2H$ (d) All are strong reducing agents

104. 

The reagent R may be

(i) CH_3CH_2MgBr (ii) CH_3CH_2Li

(iii) $(CH_3CH_2)_2Cd$ (iv) $(CH_3CH_2)_2CuLi$

(a) i or ii (b) i or ii or iii (c) iii or iv (d) Any of the four

105. Which one does not belong to the same compound?

(a) Paraformaldehyde (b) Paraldehyde

(c) Trioxane (d) Formalin

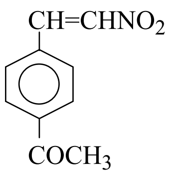
106. Which of the following is not a good reagent in Wittig reaction?

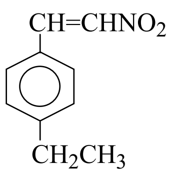
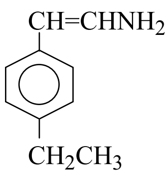
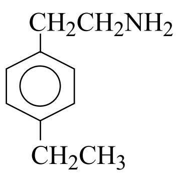
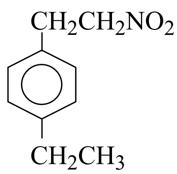
(a) $Ph_3P=CH_2$ (b) $Ph_3\overset{+}{P}\overset{-}{C}HCH_2CH_3$

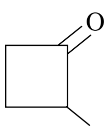
(c) $(CH_3)_3CCH{=}PPH_3$ (d) $C_6H_5COCH{=}PPh_3$

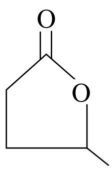
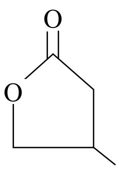
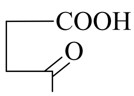
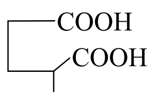
107. Which of the following is not formed in iodoform reaction?

(a) CH_3COCH_2I (b) ICH_2COCH_2I (c) CH_3COCHI_2 (d) CH_3COCI_3

108.  $\xrightarrow[HCl]{Zn/Hg}$ Product. Here, the product is

(a)  (b)  (c)  (d) 

109.  $\xrightarrow{C_6H_5COOOH}$ Product. Here, the product is

(a)  (b)  (c)  (d) 

110. Acetyl chloride does not react with

(a) Water (b) Sodium acetate

(c) 2-methylpropene (d) It reacts with all the three

111. Which of the following statement is true?

(a) At room temperature, formyl chloride is present in the form of CO and HCl.

(b) Acetamide behaves as a weak base as well as a weak acid.

(c) $CH_3CONH_2 \xrightarrow{LiAlH_4} CH_3CH_2NH_2$.

(d) All of the above.

112. Which of the following reaction is possible?

(i) $CH_3COCl + H_2O \longrightarrow CH_3COOH + HCl$

(ii) $CH_3COOCH_3 + HBr \longrightarrow CH_3COBr + CH_3OH$

(iii) $CH_3CONH_2 + HBr \longrightarrow CH_3COBr + NH_3$

(iv) $CH_3COOCOCH_3 + H_2O \longrightarrow 2CH_3COOH$

(a) i and iv (b) i, iii and iv (c) i, ii and iv (d) All the four

113. Which of the following is not possible?

(a) $ICH_2COOH + NaCl \xrightarrow{\text{Acetone}} ClCH_2COOH + NaI$

(b) $ClCH_2COOH + NaI \xrightarrow{\text{Acetone}} ICH_2COOH + NaCl$

(c) Both (a) and (b)

(d) None of these

114. Acid amide do not undergo the usual properties of carbonyl, C=O group because

(a) it is a weak base (b) it is a weak acid

(c) it is amphoteric (d) its carbonyl carbon is not electron deficient

115. Which of the following statement is true regarding aspirin, a commonly used antipyretic and analgesic? Given pK_a for aspirin = 3.5; pH in stomach and small intestine is 2.5 and 8, respectively.

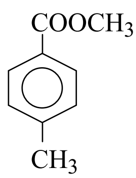
(a) It is completely ionized in the stomach and almost un-ionized in the small intestine.

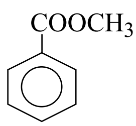
(b) It is ionized in the small intestine and almost un-ionized in the stomach.

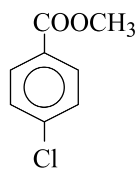
(c) It is ionized in the stomach and almost un-ionized in the small intestine.

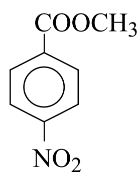
(d) It is neither ionized in stomach nor in intestine.

116. Which of the following will undergo alkaline hydrolysis most rapidly?

(a) 

(b) 

(c) 

(d) 

117. HVZ reaction involves the use of P and Cl_2

$$CH_3CH_2COOH \xrightarrow{P,\ Cl_2} CH_3CHClCOOH$$

The function of phosphorus is

(a) as a catalyst

(b) in the formation of PCl_3 which carries out halogenation at the α-carbon atom

(c) in the formation of PCl_3 which converts –COOH into –COCl

(d) none of the these

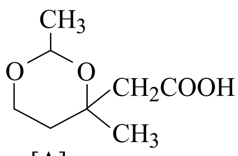
118. Hydrolysis of esters in presence of an acid is a reversible reaction. What is true about ester hydrolysis in presence of a base?

(a) It is irreversible because salts of carboxylic acids are insoluble.

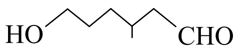
(b) It is irreversible because salts of carboxylic acids have high melting points.

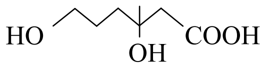
(c) It is irreversible because carboxylate ion is resonance stabilized.

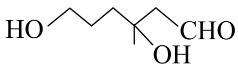
(d) It is a reversible reaction.

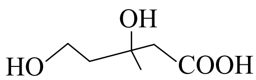
119. Compound A is formed by the interaction of 

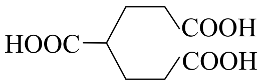
[A]

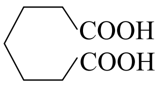
(a) CH_3COOH and 

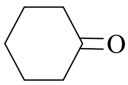
(b) CH_3CHO and 

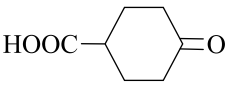
(c) CH_3COCH_2COOH and 

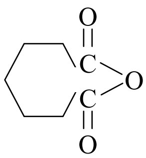
(d) CH_3CHO and 

120. What is the main product when  is heated?

(a) 

(b) 

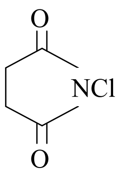
(c) 

(d) 

121. The yield of ester in esterification can be increased by

$$CH_3CH_2OH + CH_3COOH \rightleftharpoons CH_3COOCH_2CH_3 + H_2O$$

(a) removing water
(b) taking ethanol in excess
(c) taking acetic acid in excess
(d) all the above factors

122. $CH_3CH_2CH_2COOH$ +  $\xrightarrow{HCl}$ Product is

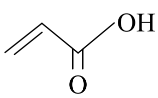
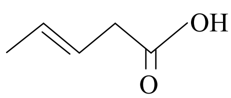
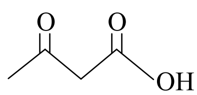
(a) $CH_3CH_2\underset{}{C}HCOOH$ (Cl on the α-carbon: $CH_3CH_2CH(Cl)COOH$)

(b) $ClCH_2CH_2CH_2COOH$

(c) $CH_3CH(Cl)CH_2COOH$

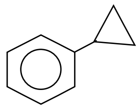
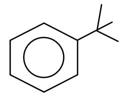
(d) All the three

123. The correct order of decarboxylation of the three acids is

(i) 
(ii) 
(iii) 

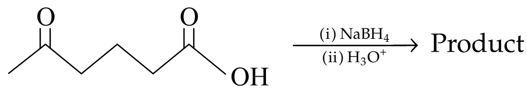
(a) iii > ii > i
(b) iii = ii > i
(c) iii > ii = i
(d) iii = ii = i

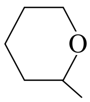
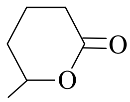
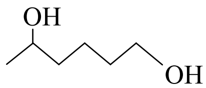
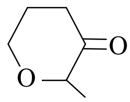
124. Which statement is true regarding oxidation of the following two compounds?

(i)    (ii) 

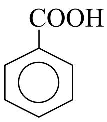
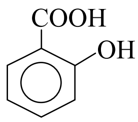
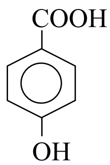
(a) Both are oxidizable to benzoic acid under similar conditions
(b) It is very difficult to oxidize either of the two
(c) Compound (i) is oxidizable to benzoic acid easily while compound (ii) is oxidizable only under vigorous conditions to benzoic acid
(d) Compound (i) is oxidizable to benzoic acid, while (ii) is oxidizable only under vigorous conditions to 2,2-dimethylpropanoic acid

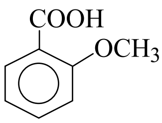
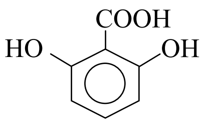
125. Predict the nature of end product in the following reaction



(a)    (b)    (c)    (d) 

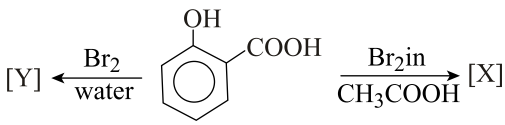
126. The correct order for the acidic character of the following carboxylic acids is

(i)    (ii)    (iii) 

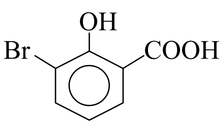
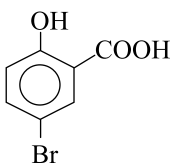
(iv)    (v) 

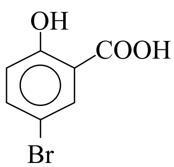
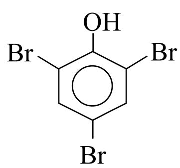
(a) iv > i > ii > iii > v   (b) v > ii > iii > i > iv
(c) v > ii > iv > iii > i   (d) v > ii > iv > i > iii

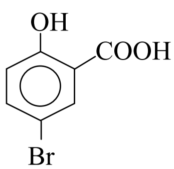
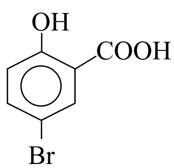
127. Salicylic acid is treated with bromine under two different conditions.

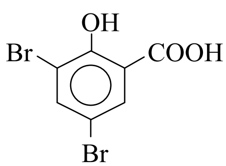
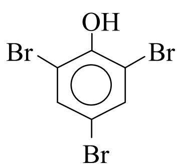


Predict the nature of [X] and [Y] in the following reactions

(a) 
[X]
; 
[Y]

(b) 
[X]
; 
[Y]

(c) 
[X]
; 
[Y]

(d) 
[X]
; 
[Y]

128. Which of the following statements is true?
(a) Hydrogen bonding always increases the acidic character of a species.
(b) Hydrogen bonding always decreases the acidic character of a species.
(c) Hydrogen bonding may increase or decrease the acidic character of a species.
(d) Hydrogen bonding play no role in determining the acidity of a species.

129. Choose the correct statement regarding acidic character of acetic acid, CH_3COOH and peroxyacetic acid, CH_3COOOH.
(a) Peroxyacetic acid is stronger acid than acetic acid since the former has one extra oxygen, an electronegative element.
(b) Peroxyacetic acid is stronger than acetic acid because its conjugate base is a weaker base than acetate.
(c) Peroxyacetic acid is weaker than acetic acid because its conjugate base is less stable than that of acetate ion.
(d) Both are equally strong.

130. A carboxylic acid can best be converted into acid chloride by using
(a) PCl_5 (b) $SOCl_2$ (c) HCl (d) ClCOCOCl

131. The yield of acid amide in the reaction, $RCOCl + NH_3 \longrightarrow RCONH_2$, is maximum when
(a) acid chloride and ammonia are treated in equimolar ratio
(b) acid chloride and ammonia are treated in 1:2 molar ratio
(c) acid chloride and ammonia are treated in 2:1 molar ratio
(d) All the three give nearly similar result

132. Which of the following statement is not upto the mark?
(a) $R-\overset{\overset{O}{||}}{C}-OR' \xrightarrow{OH^-} R-\overset{\overset{O}{||}}{C}-O^- + R'OH$ (a base-catalyzed reaction)
(b) $CH_3COOC_2H_5 \xrightarrow{OH^-} CH_3COOH + C_2H_5OH$ (reaction involves acyl-oxygen fission)
(c) $C_6H_5COOH + CH_3OH \xrightarrow{H^+} C_6H_5COOCH_3 + H_2O$ (reaction involves acyl-oxygen fission)
(d) $CH_3COOCH(CH_3)C_2H_5 \xrightarrow{OH^-} CH_3COO^- + HOCH(CH_3)C_2H_5$ (configuration of the reactant is retained)

133. The products in the following reaction are

$$C_6H_5COOCH_2C_6H_5 \xrightarrow{H_2-Pd/C}$$

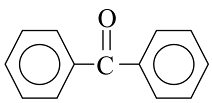
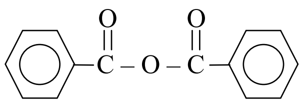
(a) $C_6H_5CH_2OH + C_6H_5CH_2OH$ (b) $C_6H_5CH_3 + C_6H_5CH_3$
(c) $C_6H_5CH_2OH + C_6H_5CH_3$ (d) $C_6H_5COOH + C_6H_5CH_3$

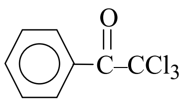
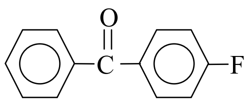
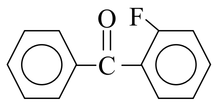
134. Pyrolysis of $CH_3COO\underset{\underset{CH_3}{|}}{C}HCH_2CH_3$ gives
(a) 1-butene and 2-butene in equimolar ratio
(b) 1-butene and 2-butene in 1:2 molar ratio
(c) 1-butene and 2-butene in 3:2 molar ratio
(d) 1-butene and 2-butene in 2:3 molar ratio

135. The relative stability of the four acid derivatives towards nucleophiles is
(a) Amide > Ester > Acid anhydride > Acid chloride
(b) Amide > Acid anhydride > Ester > Acid chloride
(c) Acid chloride > Acid anhydride > Ester > Amide
(d) Acid chloride > Ester > Acid anhydride > Amide

136. Which of the following statement is true about the hydrolysis of acetic anhydride?
(i) It is more easily hydrolyzed in acidic medium than in neutral.
(ii) It is more easily hydrolyzed in alkaline medium than in neutral.
(iii) It is equally hydrolyzed in all the three media.
(iv) It is more easily hydrolyzed in neutral than in acidic media.
(v) It is more easily hydrolyzed in neutral than in alkaline medium.
(a) i and ii (b) iii (c) iv and v (d) i and v

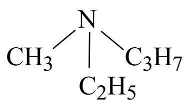
137. Which of the following compounds can undergo nucleophilic substitution easily?

(i)  (ii) 

(iii)  (iv)  (v) 

(a) Only ii (b) i, ii, iii and iv
(c) ii, iii and v (d) ii, iii and iv

138. Which statement is true regarding the following structure?

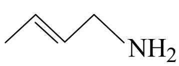
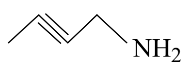


(a) It is a chiral molecule (b) It exists in two resolvable optically active forms
(c) Both (a) and (b) (d) Neither (a) nor (b)

139. Introduction of a methyl group in ammonia markedly increases the basic strength of ammonia in aq. solution, but introduction of the second methyl group increases only marginally the basic strength of methyl amine in water. This is due to
(a) different type of hybridization in the two amines.
(b) protonated dimethyl amines are more solvated than methyl amine.
(c) protonated dimethyl amine is more solvated than the protonated methyl amine.
(d) protonated dimethyl amine is less stable than the protonated methyl amine.

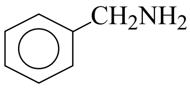
140. The basic character of ethyl amine, diethyl amine and triethyl amine in chlorobenzene is
(a) $C_2H_5NH_2 < (C_2H_5)_2NH < (C_2H_5)_3N$ (b) $C_2H_5NH_2 < (C_2H_5)_3N < (C_2H_5)_2NH$
(c) $(C_2H_5)_3N < (C_2H_5)_2NH < C_2H_5NH_2$ (d) $(C_2H_5)_3N < C_2H_5NH_2 < (C_2H_5)_2NH$

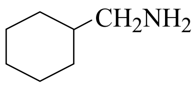
141. The correct order of decreasing basic character of the three aliphatic primary amines is

(i)  (ii)  (iii) 

(a) i > ii > iii (b) iii > ii > i (c) i > ii ≈ iii (d) i = ii ≡ iii

142. Which of the statement is true regarding the basicity of the following two primary amines?

(i) 

(ii) 

(a) Both are equally basic because both are 1° amines.
(b) i > ii because it is an aromatic amine.
(c) ii > i because it is an aliphatic amine
(d) i < ii because of difference in the nature of β-carbon.

143. The correct order of decreasing basic character is

(i) $C_6H_5NH_2$ (ii) $C_6H_5CH_2NH_2$ (iii) $(C_6H_5)_2NH$ (iv) $C_6H_{11}NH_2$

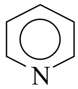
(a) ii > i > iii > iv (b) iv > ii > i > iii
(c) iv > iii > ii > i (d) iv > ii > iii > i

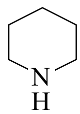
144. The correct order of increasing basicity is

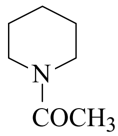
(i) $CH_3CH_2NH_2$ (ii) $CH_3C(=NH)NH_2$ (iii) $CH_3C(=O)NH_2$

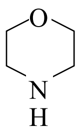
(a) ii < iii < i (b) i ≈ iii < ii (c) i < ii < iii (d) iii < i < ii

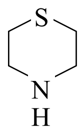
145. The relative order of basic character of the following compound is

(i) 

(ii) 

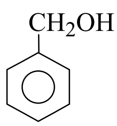
(iii) 

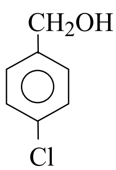
(iv) 

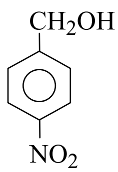
(v) 

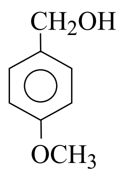
(a) ii > i > iii > iv > v (b) ii > iii > iv > v > i
(c) ii > v > iv > i > iii (d) ii > iv > v > iii > i

146. The basic character of the following alcohols is

(i) 

(ii) 

(iii) 

(iv) 

(a) iv > i > ii > iii (b) ii > iii > iv > i
(c) iv > ii > iii > i (d) i > ii > iii > iv

147. When aniline is treated with acetyl chloride in presence of anhydrous aluminium chloride, the main product is

(a) o-aminoacetophenone (b) p-aminoacetophenone
(c) Both (a) and (b) (d) m-aminoacetophenone

148. $CH_3CH_2CH_2NH_2 \xrightarrow[0°C]{NaNO_2,\ HCl}$ P. P is

(a) $CH_3CH_2CH_2OH$ (b) $(CH_3)_2CHCl$
(c) Both (a) and (b) (d) Reaction not possible

149. Benzenediazonium chloride when treated with phenols gives an azo dye, to get best result the pH of the medium should be

(a) around 4 (b) around 8 (c) around 10 (d) 12

150. In the following reaction, the reagent X should be

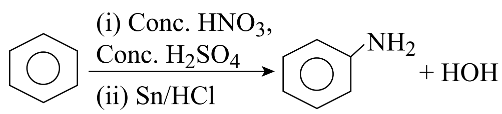
$$RCOOH + [X] \xrightarrow{Conc.\ H_2SO_4} RNH_2$$

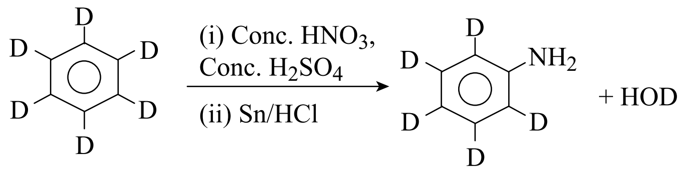
(a) NH_3 (b) HN_3 (c) Either of the two (d) None of the two

151. Which of the following can undergo electrophilic substitution when treated with nitrous acid at 0ºC?

(a) $C_6H_5NH_2$ (b) $C_6H_5NHCH_3$ (c) $C_6H_5N(CH_3)_2$ (d) None of these

152. Which of the two reactions proceed faster?

(i) 

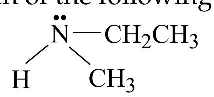
(ii) 

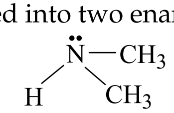
(a) i (b) ii (c) i = ii (d) Not definite

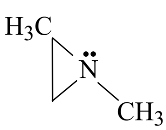
153. Which of the following does not reduce $C_6H_5NO_2$ to aniline?

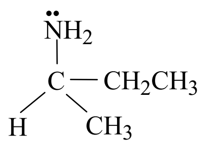
(a) Sn/HCl (b) $SnCl_2$/HCl (c) Zn/HCl (d) $LiAlH_4$

154. Which of the following amines can be resolved into two enantiomers?

(i) 

(ii) 

(iii) 

(iv) 

(a) i, iv (b) i, ii (c) i, iii, iv (d) iii, iv

155. Which of the following statement is false?

(a) Dimethyl amine as well as trimethyl amine are soluble in water.
(b) Trimethyl amine forms hydrogen bond neither with itself nor with water.
(c) Trimethyl amine can act as hydrogen bond acceptor only, while dimethyl amine can serve as both a hydrogen bond donor and acceptor.
(d) All the three statements are false.

156. Ephedrine is a secondary amine. It is widely used in cold and allergy conditions in the form of its hydrochloride but not as such because

(a) the amine itself has an unpleasant smell, while its salt is odourless.

(b) the amine is insoluble in water, while the salt is soluble in water.

(c) the amine is unstable and easily oxidized by air, while the salt is resistant to atmospheric oxidation.

(d) of all the above facts

157. Benzamide and benzyl amine can be distinguished by

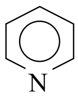
(a) cold. dil. NaOH

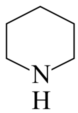
(b) cold dil. HCl

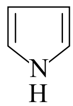
(c) both (a) and (b)

(d) $NaNO_2$, HCl, 0°C, then β-naphthol

158. The correct order for the basic character of the compounds i to iv should be

(i) 

(ii) 

(iii) 

(iv) CH_3CN

(a) iv < iii < i < ii

(b) iv < i < iii < ii

(c) iv < ii < iii < i

(d) iv < iii < ii < i

159. Which of the following is true regarding basic character of pyridine and pyrrole?

(a) Pyrrole is more basic because its non-bonding electrons occupy sp^3 orbital.

(b) Pyridine is more basic because its non-bonding electrons are not part of aromatic sextet.

(c) Both are equally basic.

(d) Pyridine is less basic because it is a tertiary amine.

160. Pyrrole and pyridine both are basic and form salts with acids.



(i) (ii) (iii) (iv)

Which of the following statement is true regarding the aromatic character of the four species?

(a) All the four are aromatic

(b) i, iii and iv are aromatic

(c) i, ii and iii are aromatic

(d) i and iii are aromatic

161. Ethylene can be prepared in good yield by

(a) $CH_3CH_2N^+(CH_3)_3I^- \xrightarrow{\text{Heat}} CH_2=CH_2 + (CH_3)_3N + HI$

(b) $CH_3CH_2N^+(CH_3)_3OH^- \xrightarrow{\text{Heat}} CH_2=CH_2 + (CH_3)_3N + H_2O$

(c) Both (a) and (b)

(d) $CH_3CH_2NH_2 \xrightarrow{\text{Heat}} CH_2=CH_2 + NH_3$

162. Which one of the following is not an oxidation product of a primary amine?

(a) A hydroxylamine

(b) A nitroso compound

(c) A nitro compound

(d) None of these

163. Which of the following method is used for eliminating nitrogen of an amine present outside the ring?

(a) Hofmann elimination (b) Cope elimination
(c) Both (a) and (b) (d) Emde degradation

164. Which of the following does not react with nitrous acid?

(a) $C_6H_5NH_2$ (b) $C_6H_5NHCH_3$ (c) $C_6H_5N(CH_3)_2$ (d) None of these

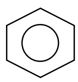
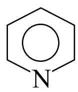
165. Which of the following leads to carbon–carbon double bond?

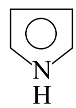
(a) 1° amine + RCHO $\longrightarrow$ (b) 2° Amine + $R_2CO \longrightarrow$
(c) 2° amine + RCHO $\longrightarrow$ (d) Both (b) and (c)

166. Electrophilic aromatic substitution of pyridine resembles with

(a) benzene (b) aniline (c) nitrobenzene (d) none of these

167. Arrange the following compounds in decreasing order of reactivity towards electrophilic substitution.

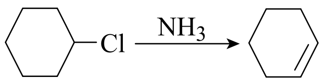
(i)  (ii) 

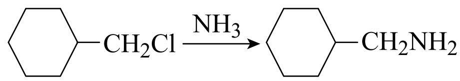
(iii) 

(a) i > ii > iii (b) i > ii = iii (c) iii > ii > i (d) iii > i > ii

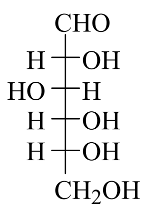
168. Which reaction seems to be incorrect?

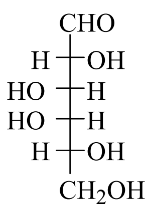
(a) $Me_3CCl \xrightarrow{NH_3} Me_3CNH_2$ (b) $Me_3CCl \xrightarrow{NH_3} Me_2C=CH_2$

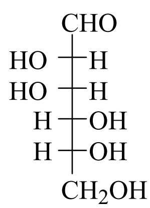
(c) 

(d) 

169. Which of the statement regarding following structure is true?

(i) 

(ii) 

(iii) 

(a) (i) and (ii) are epimers (b) (i) and (iii) are epimers
(c) Both (a) and (b) are true (d) All the three are epimers

170. Which of the following pair represents an example of diastereoisomers

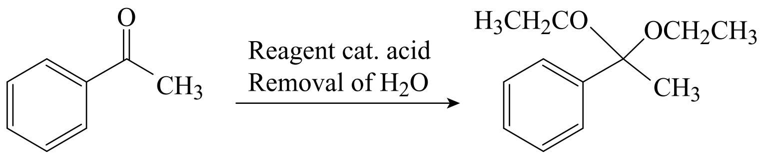
(i) (+)-Tartaric acid and meso-tartaric acid
(ii) Maleic acid and fumaric acid
(iii) D(+)-Galactose and D(+)-mannose
(iv) (+)-Lactic acid and (–)-Lactic acid

(a) i and iii (b) i, iii and iv (c) i, ii and iii (d) iv

LEVEL 2

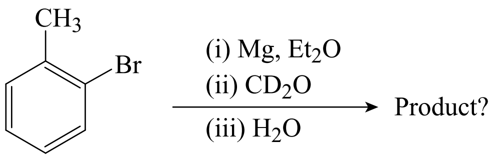
Single and Multiple-choice Type

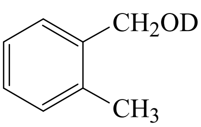
1. What could be the reagent for the following reaction?

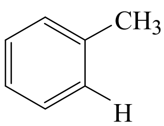


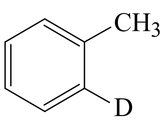
(a) CH_3COCH_3 (b) CH_3OH (c) CH_3CH_2OH (d) $HOCH_2CH_2OH$

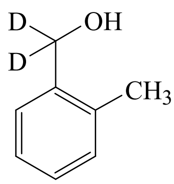
2. What could be the product for the following reaction?



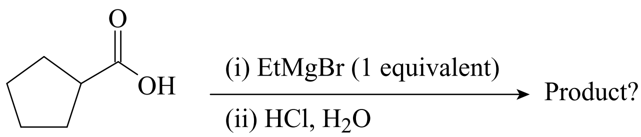
(a) 

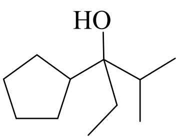
(b) 

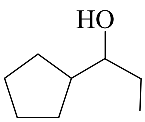
(c) 

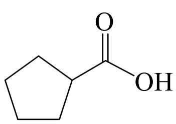
(d) 

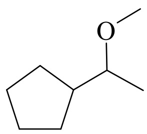
3. What could be the major product for the following reaction?



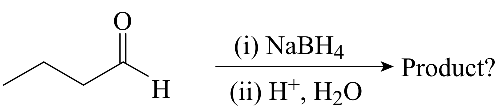
(a) 

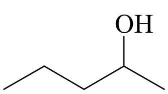
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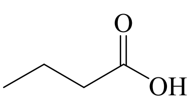
(c) 

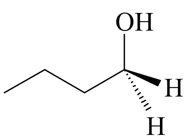
(d) 

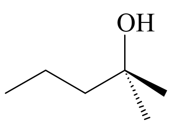
4. What could be the product for the following reaction?



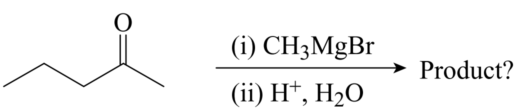
(a) 

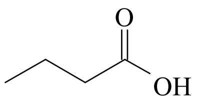
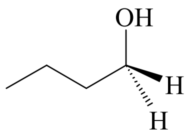
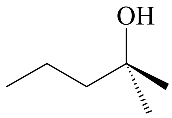
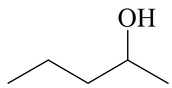
(b) 

(c) 

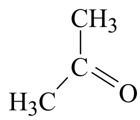
(d) 

5. What could be the product for the following reaction?



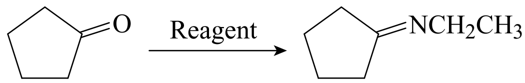
(a) 
(b) 
(c) 
(d) 

6. What is not the name for the following compound?



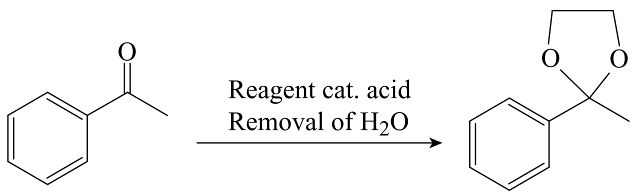
(a) 2-Acetaldehyde (b) propanone (c) acetone (d) dimethyl ketone

7. What could be the reagent for the following reaction?

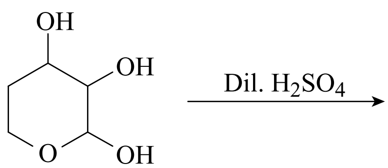


(a) H_2N–Ph, removal of water
(b) $H_2NCH_2CH_3$, CH_3CO_2H, removal of water
(c) H_2NCH_3, H_2O, removal of water
(d) $H_2NCH_2CH_2CH_3$, CH_3CO_2H, removal of water

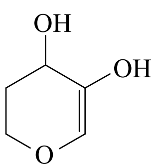
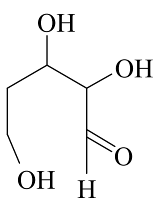
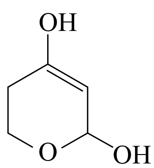
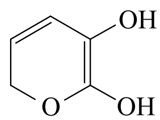
8. What could be the reagent for the following reaction?

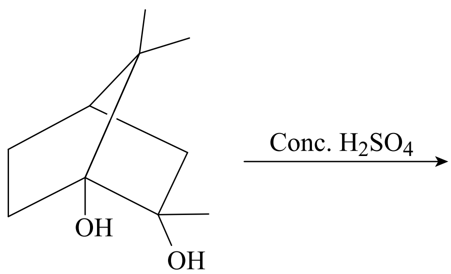


(a) CH_3COCH_3 (b) $HOCH_2CH_2OH$ (c) CH_3CH_2OH (d) CH_3OH

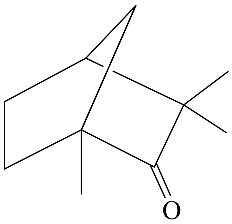
9. 

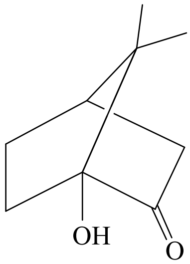
Major product is?

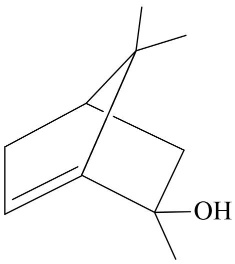
(a) 
(b) 
(c) 
(d) 

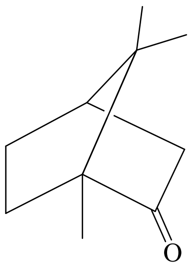
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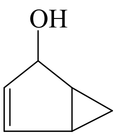
Major product is?

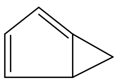
(a) 

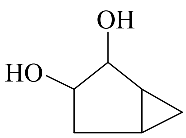
(b) 

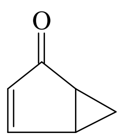
(c) 

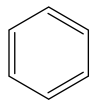
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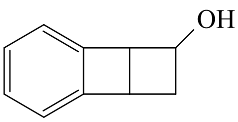
11.  $\xrightarrow[\Delta]{\text{Conc. } H_2SO_4}$ Major product is?

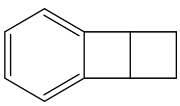
(a) 

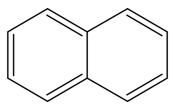
(b) 

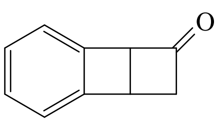
(c) 

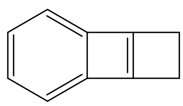
(d) 

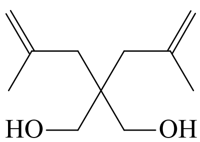
12.  $\xrightarrow[\Delta]{\text{Conc. } H_2SO_4}$ Major product is?

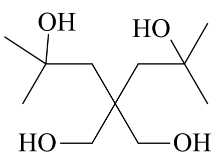
(a) 

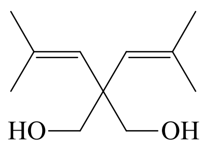
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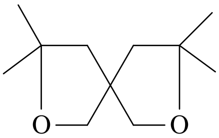
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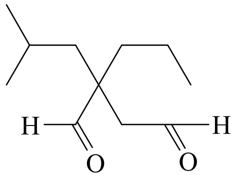
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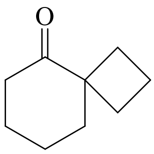
13.  $\xrightarrow{\text{Dil. } H_2SO_4}$ Major product is?

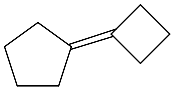
(a) 

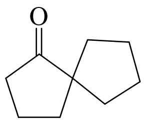
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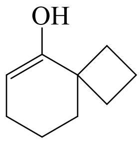
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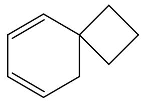
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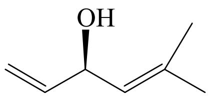
14.  $\xrightarrow[\Delta]{\text{Conc. } H_2SO_4}$ Major prodcut is?

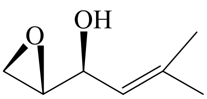
(a) 

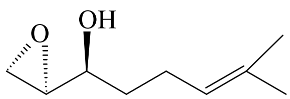
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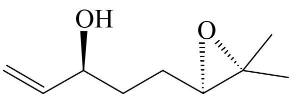
(c) 

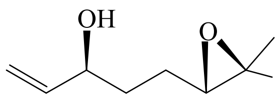
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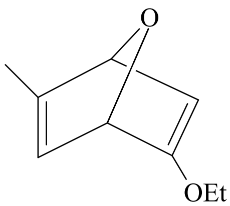
15.  $\xrightarrow{\text{1 equivalent mCPBA}}$ Major product is?

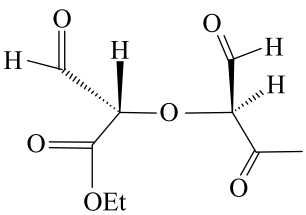
(a) 

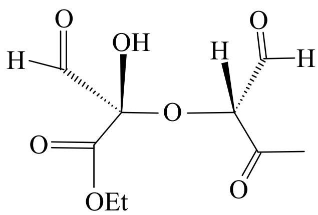
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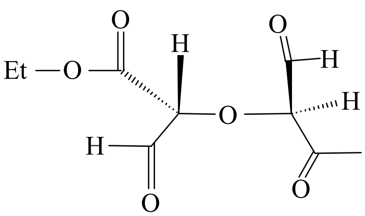
(c) 

(d) 

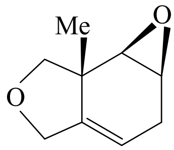
16.  $\xrightarrow[\text{(ii) } PPh_3]{\text{(i) } O_3}$ Major product is?

(a) 

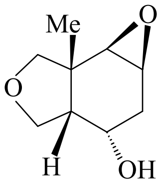
(b) 

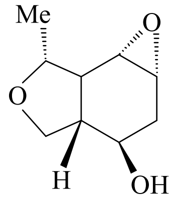
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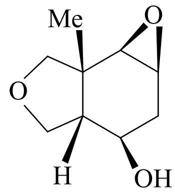
(d) None of these

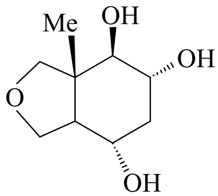
17. 

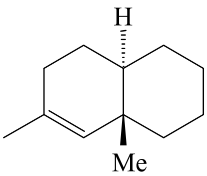
(i) BH_3 - THF, (ii) H_2O_2 → Major product is?

(a) 

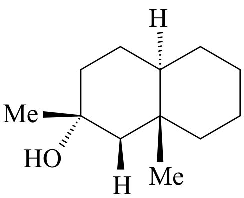
(b) 

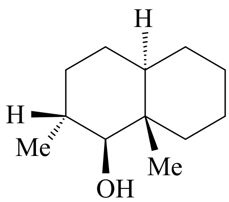
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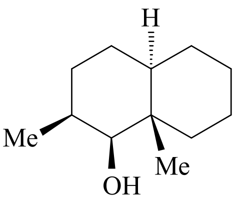
(d) 

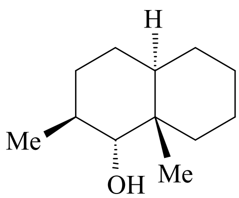
18. 

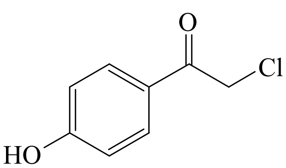
(i) mCPBA, (ii) DIBAL-H, (iii) H_3O^+ → Major product is?

(a) 

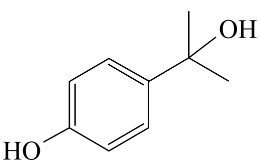
(b) 

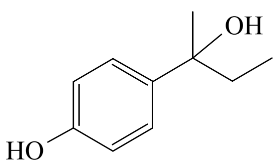
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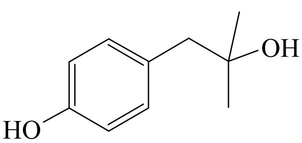
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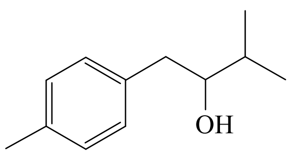
19. 

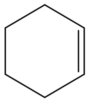
(i) Excess of Me MgCl, (ii) H_2O / H^+ → Major product

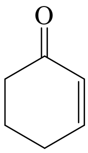
(a) 

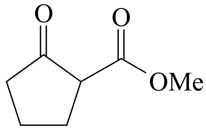
(b) 

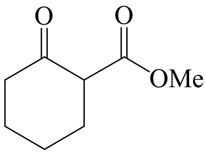
(c) 

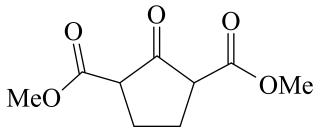
(d) 

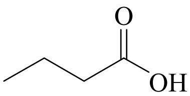
20.  (i) O_3 / H_2O_2 (ii) Excess of MeOH /H^+ (iii) NaOMe / MeOH → Major product is?

(a) 

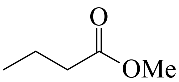
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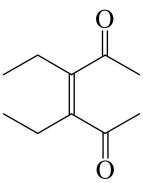
(c) 

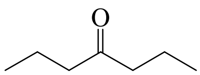
(d) 

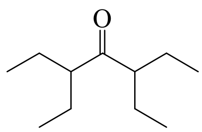
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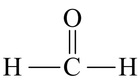
(i) MeOH / H^+ (ii) NaOMe / MeOH (iii) Aqueous NaOH (iv) H^+ /Δ → Major product of reaction is?

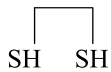
(a) 

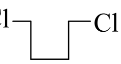
(b) 

(c) 

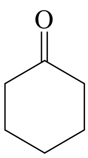
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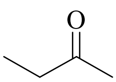
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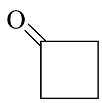
(i) 

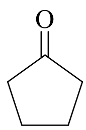
/ H^+ (ii) 2 eq. RLi/

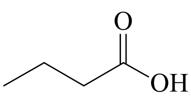
(iii) H_3O^+ → Major product is?

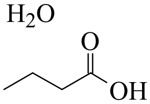
(a) 

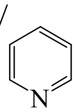
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(c) 

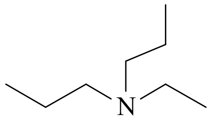
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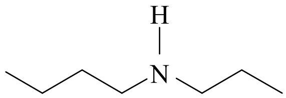
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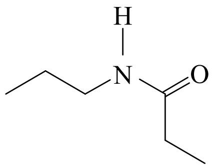
(i) $SOCl_2$ (ii) NaN_3 (iii) Ag_2O /Δ (iv) H_2O (v) 

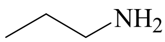
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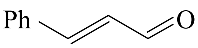
(vi) LAH → Major product is?

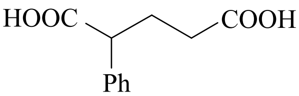
(a) 

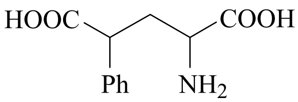
(b) 

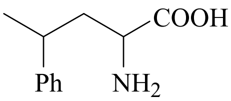
(c) 

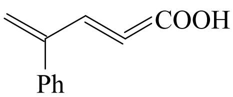
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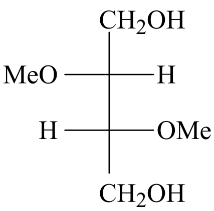
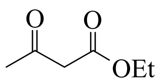
24.  (i) NaCN; (ii) NH_3 /Δ / H^+; (iii) HCN; (iv) H_3O^+ → Major product is?

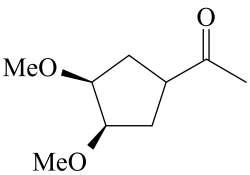
(a) 

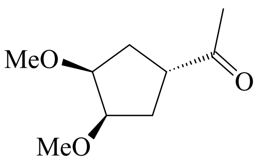
(b) 

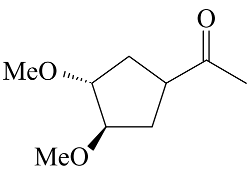
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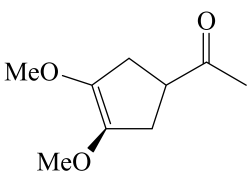
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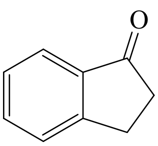
25.  (i) PBr_3 (2 eq.); (ii)  / NaOEt; (iii) Aq. NaOH; (iv) H^+ /Δ → Major product is?

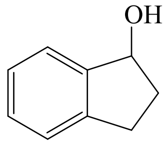
(a) 

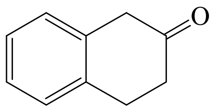
(b) 

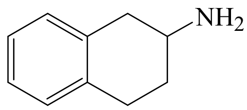
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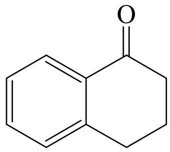
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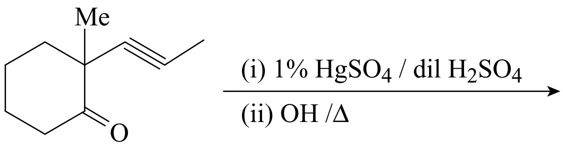
26.  (i) HCN; (ii) $LiAlH_4$; (iii) $NaNO_2$ + HCl → Major product is?

(a) 

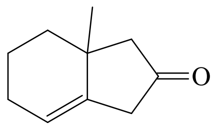
(b) 

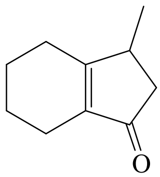
(c) 

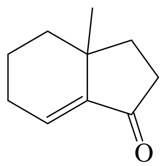
(d) 

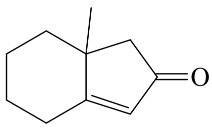
27. 

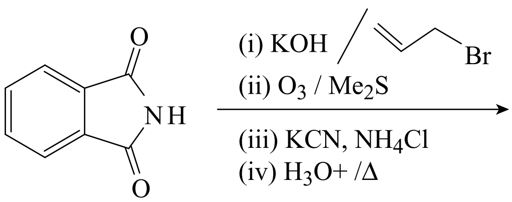
Major product is?

(a) 

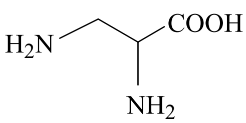
(b) 

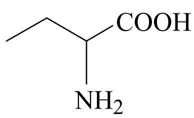
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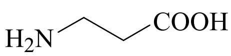
(d) 

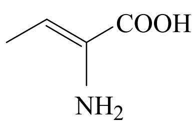
28. 

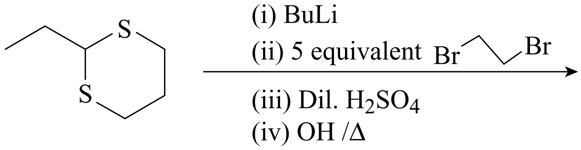
Major product is?

(a) 

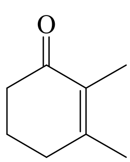
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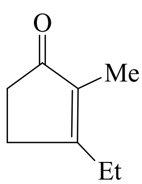
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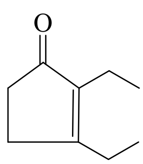
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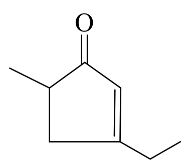
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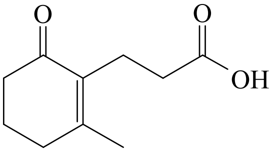
Major product is?

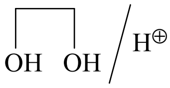
(a) 

(b) 

(c) 

(d) 

30. 

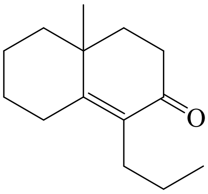
(i) 

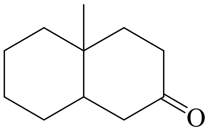
(ii) BuLi (excess)

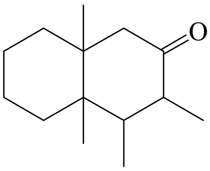
(iii) Dil. H_2SO_4

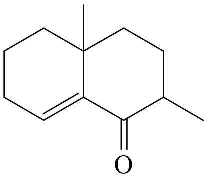
(iv) OH /Δ

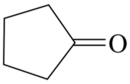
→ Major product is?

(a) 

(b) 

(c) 

(d) 

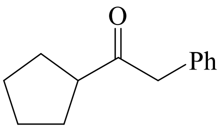
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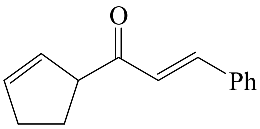
(i) $CH\equiv C^{\ominus}Na^{\oplus}$

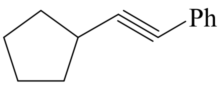
(ii) $HgSO_4$, dil H_2SO_4

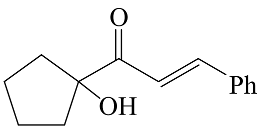
(iii) Ph–CHO / OH

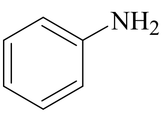
→ Major product is?

(a) 

(b) 

(c) 

(d) 

32. 

(i) AC_2O

(ii) HNO_3, H_2SO_4

(iii) H_3O^+

(iv) $Br_2 + NaHCO_3$

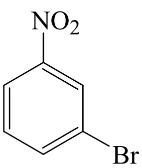
(v) $NaNO_2 + HCl$

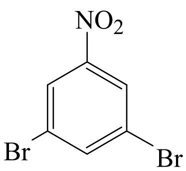
(vi) H_3PO_2

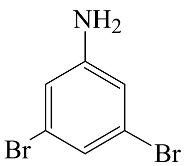
(vii) Fe + HCl

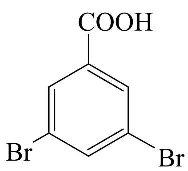
(viii) OH / H_2O

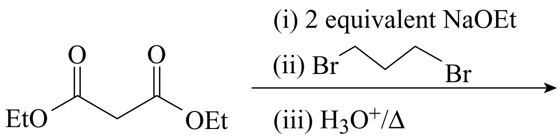
→ Major product of reaction?

(a) 

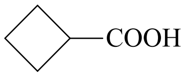
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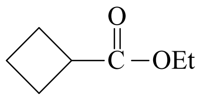
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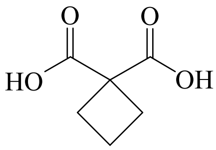
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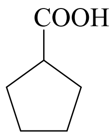
33. 

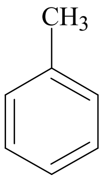
Major product is?

(a) 

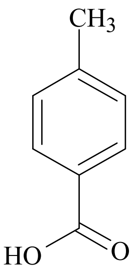
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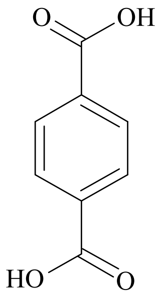
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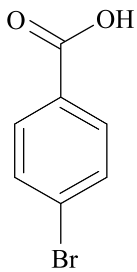
(d) 

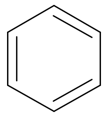
34. 

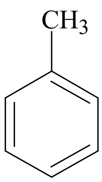
(i) Br_2 / Fe
(ii) $K_2Cr_2O_7$ / H^+ / Δ
(iii) Li / Et_2O
(iv) CO_2 / H^+
→ Identify product?

(a) 

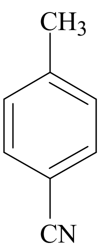
(b) 

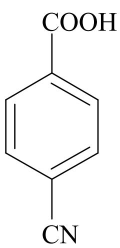
(c) 

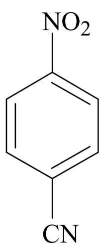
(d) 

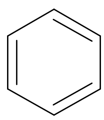
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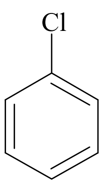
(i) HNO_3 / H_2SO_4 /Δ
(ii) LAH
(iii) $NaNO_2$ + HCl / 0–5°C
(iv) CuCN
→ Identify product?

(a) 

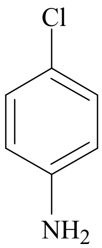
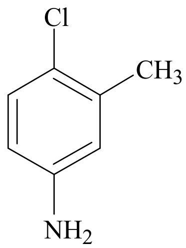
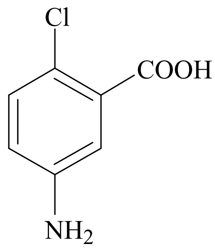
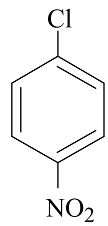
(b) 

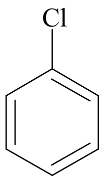
(c) 

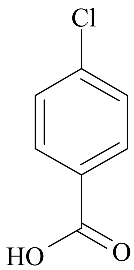
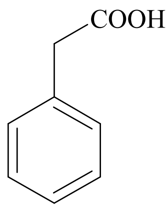
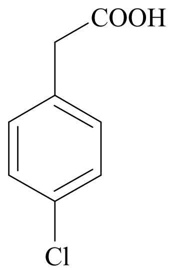
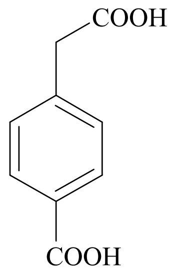
(d) 

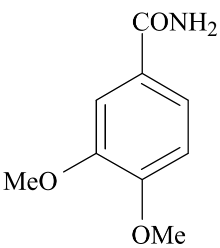
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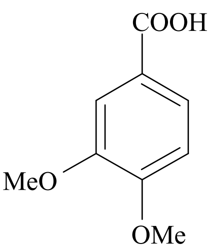
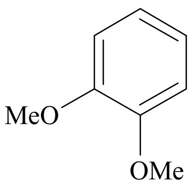
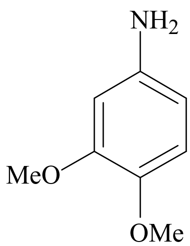
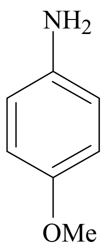
(i) HNO_3 / H_2SO_4 /Δ
(ii) CH_3Cl / $AlCl_3$
(iii) Sn /HCl
(iv) NaOH /H_2O
→ Identify product?

(a)  (b)  (c)  (d) 

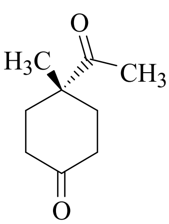
37.  (i) Li / Et_2O (ii) HCHO Then H^+ (iii) HCl → (iv) Li / Et_2O (v) CO_2, Then H^+ Identify product?

(a)  (b)  (c)  (d) 

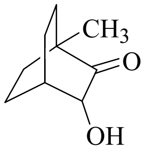
38.  $\xrightarrow{NaOH / Br_2}$ Identify product?

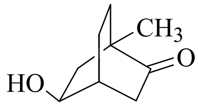
(a)  (b)  (c)  (d) 

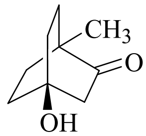
39. In the presence of a base, the compound below cyclizes to give a compound Y.

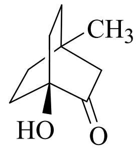
 $\xrightarrow[H_2O]{Na_2CO_3}$

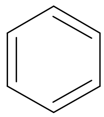
Identify the structure of compound Y.

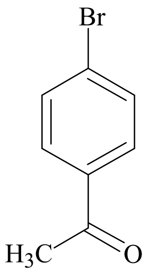
(a) 

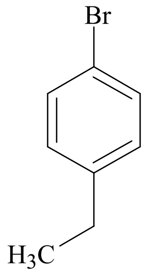
(b) 

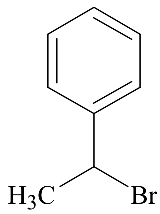
(c) 

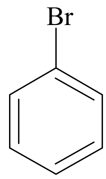
(d) 

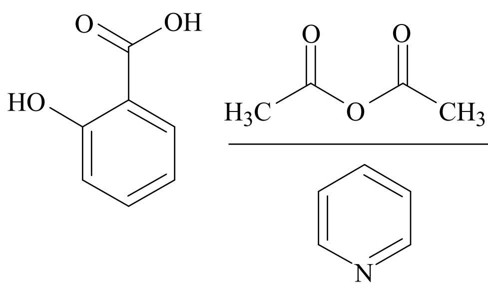
40.  (i) CH_3COCl / $AlCl_3$ (ii) Zn–Hg /HCl (iii) Br_2 / hν → Identify product?

(a) 

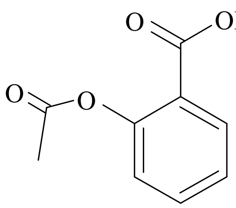
(b) 

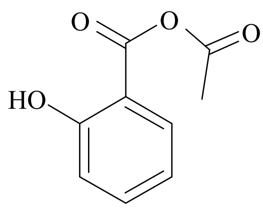
(c) 

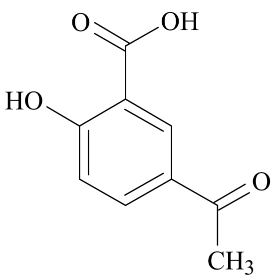
(d) 

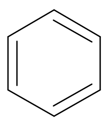
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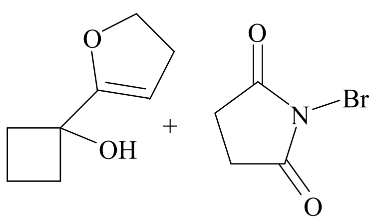
Identify product?

(a) 

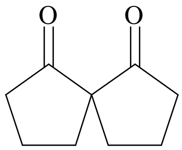
(b) 

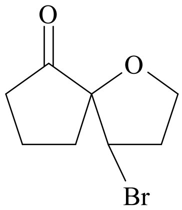
(c) 

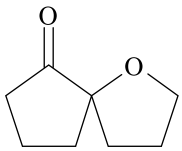
(d) 

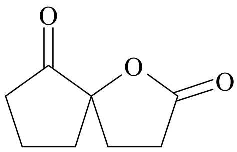
42. 

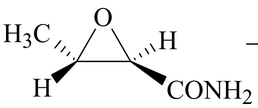
Product. Identify product?

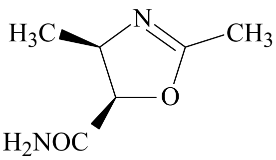
(a) 

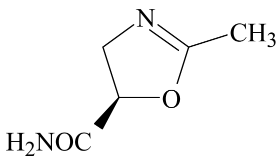
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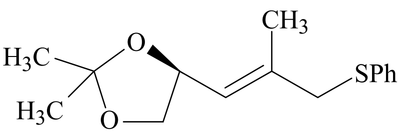
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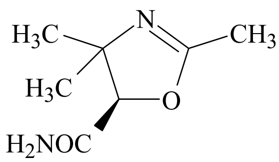
(d) 

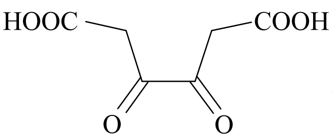
43.  $\xrightarrow{BF_3\ /\ MeCN}$ Identify product?

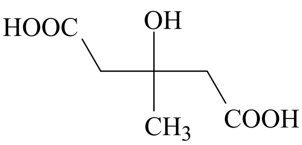
(a) 

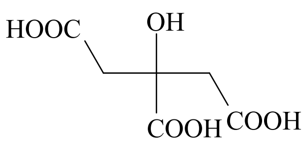
(b) 

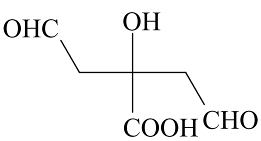
(c) 

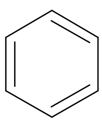
(d) 

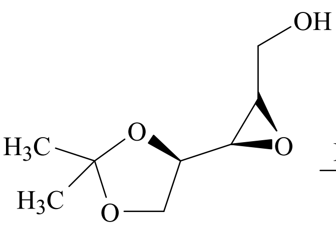
44.  $\xrightarrow[\text{(ii) } H_3O^+]{\text{(i) NaOH, } H_2O}$ Identify product?

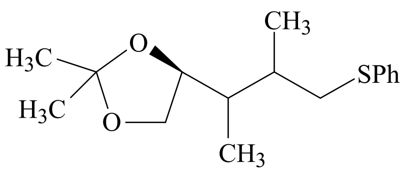
(a) 

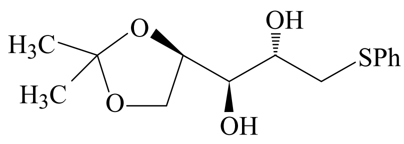
(b) 

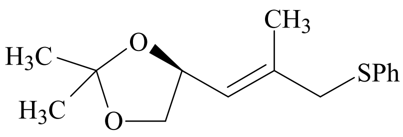
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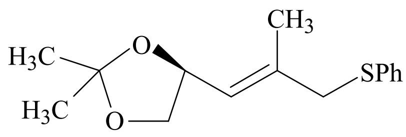
(d) 

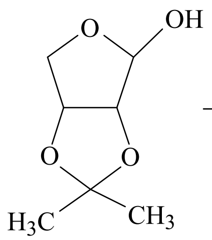
45.  $\xrightarrow{PhSNa,\ H_2O}$ Identify product?

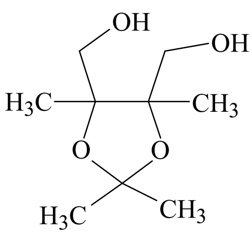
(a) 

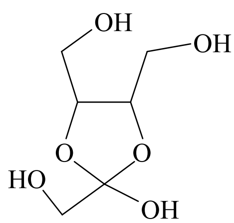
(b) 

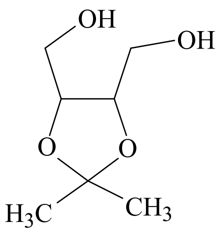
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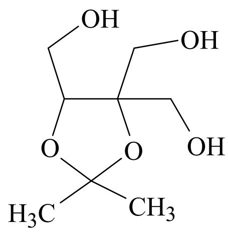
(d) 

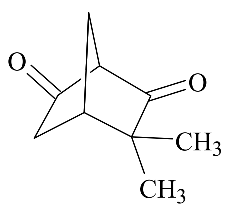
46.  Excess of NaOH, H_2O / Excess of HCHO → Identify product?

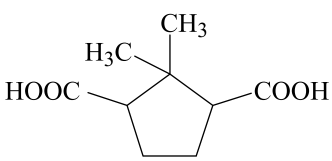
(a) 

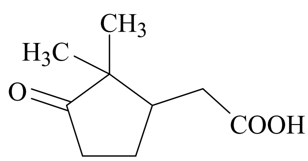
(b) 

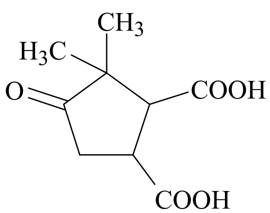
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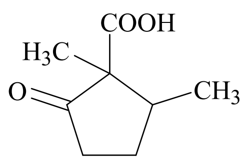
(d) 

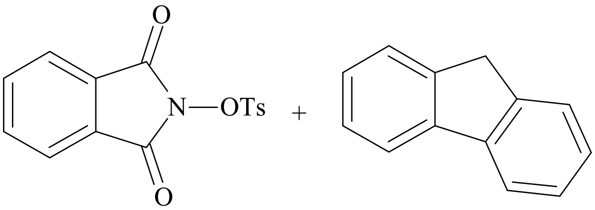
47.  (i) NaOH, H_2O (ii) H_3O^+ → Identify product?

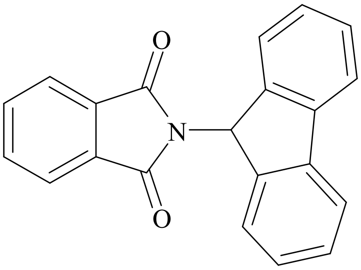
(a) 

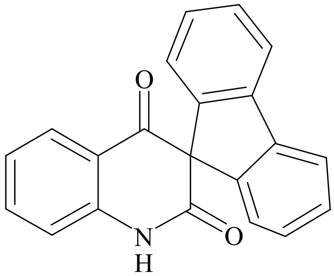
(b) 

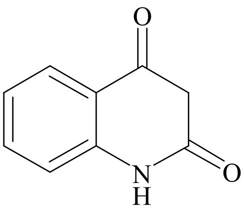
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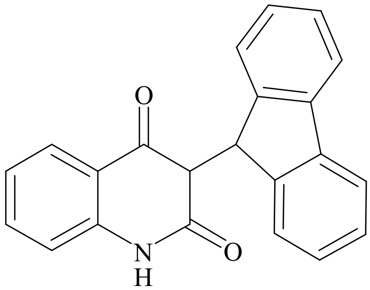
(d) 

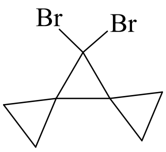
48.  $\xrightarrow{\text{2eq. BuLi}}$ Identify product?

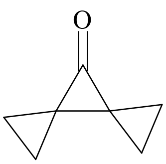
(a) 

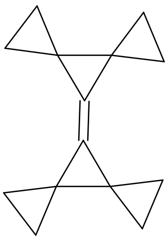
(b) 

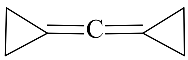
(c) 

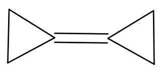
(d) 

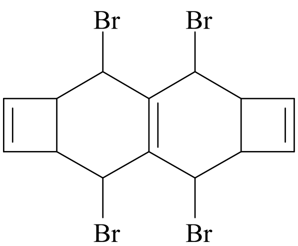
49.  $\xrightarrow{\text{BuLi}}$ Identify product?

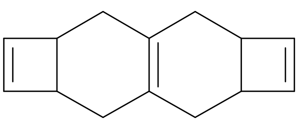
(a) 

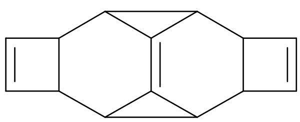
(b) 

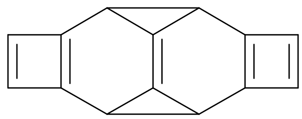
(c) 

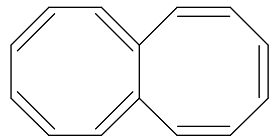
(d) 

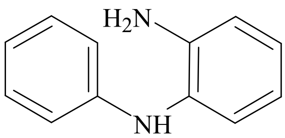
50.  $\xrightarrow[\text{Acetone }/\Delta]{\text{2 eq. of NaI}}$ Identify product?

(a) 

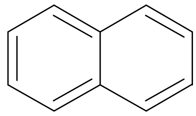
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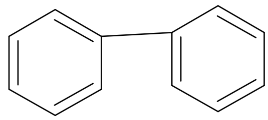
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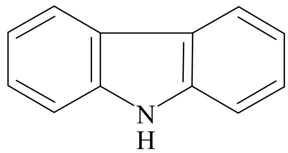
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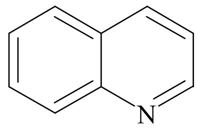
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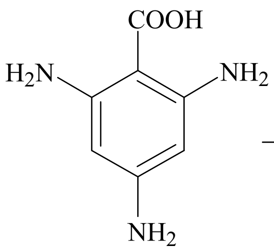
$\xrightarrow[\text{then, } \Delta]{NaNO_2\text{, then HCl, } 0\ ^\circ C}$ Identify product?

(a) 

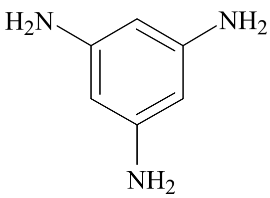
(b) 

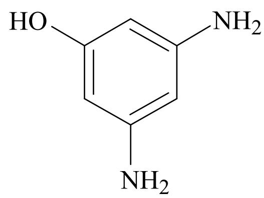
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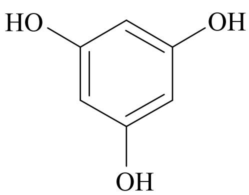
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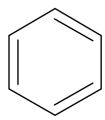
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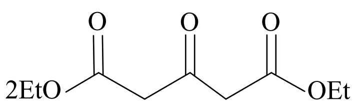
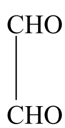
$\xrightarrow[\Delta]{H_3O^+}$ Identify product?

(a) 

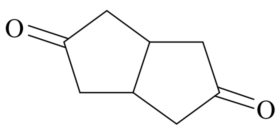
(b) 

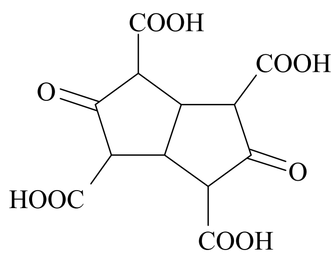
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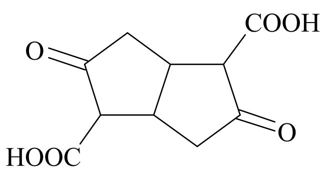
(d) 

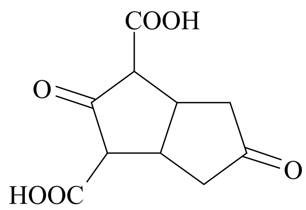
53.  + 

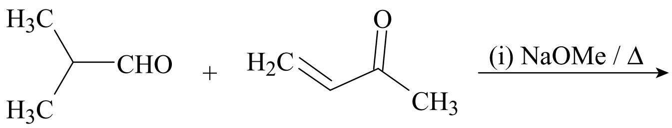
$\xrightarrow{\text{(i) 2eq. NaOMe / }\Delta\text{ (ii) NaOH / }\Delta}$ Identify product?

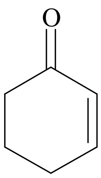
(a) 

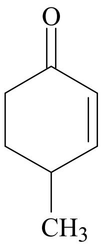
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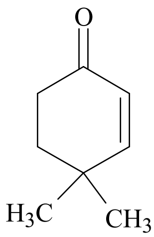
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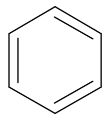
(d) 

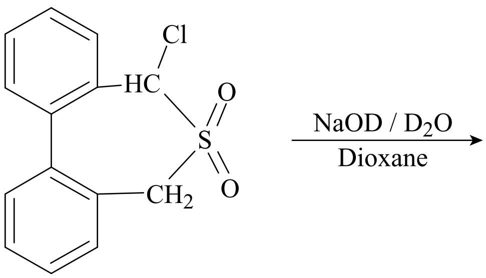
54.  Identify product?

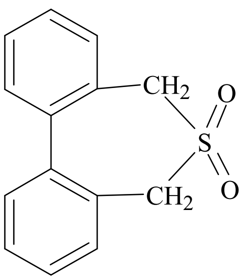
(a) 

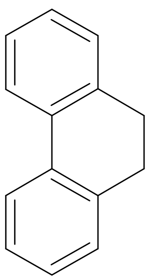
(b) 

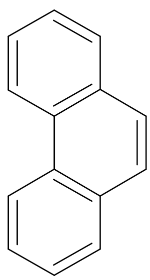
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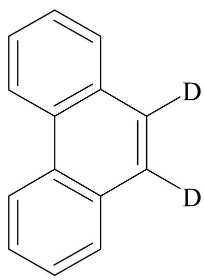
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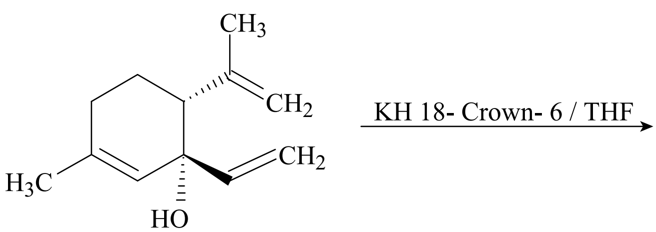
55.  Identify product?

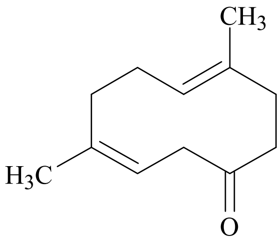
(a) 

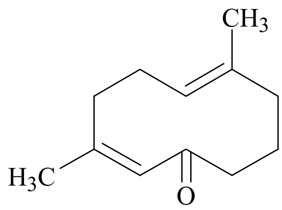
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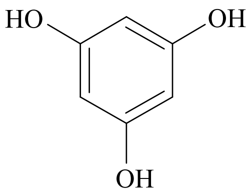
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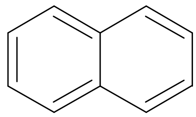
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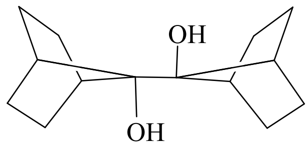
56.  Identify product?

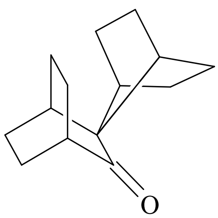
(a) 

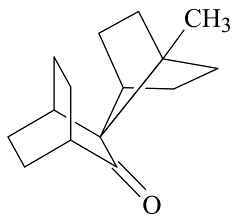
(b) 

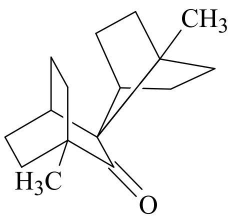
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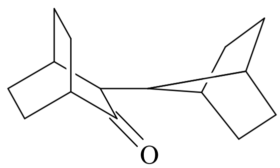
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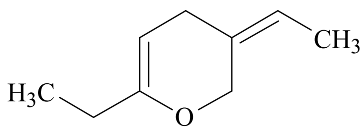
57.  $\xrightarrow{\text{Conc. } H_2SO_4}$ Identify product?

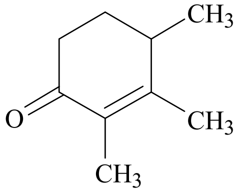
(a) 

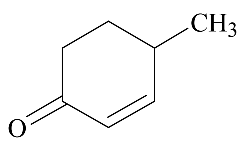
(b) 

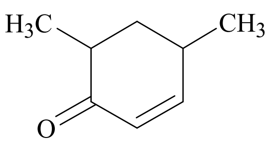
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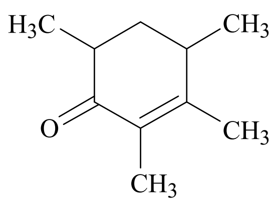
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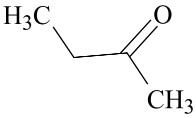
58.  $\xrightarrow{\text{Conc. } H_2SO_4}$ Identify product?

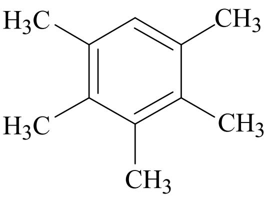
(a) 

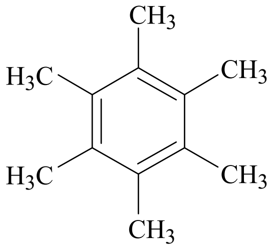
(b) 

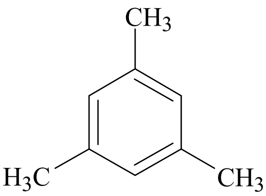
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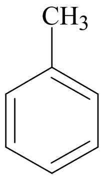
(d) 

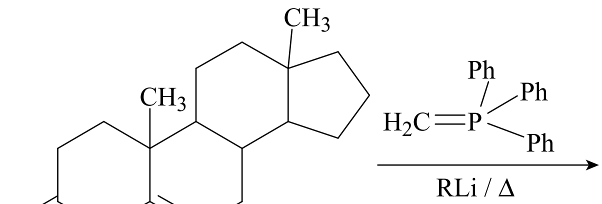
59.  Conc. H_2SO_4 → Identify product?

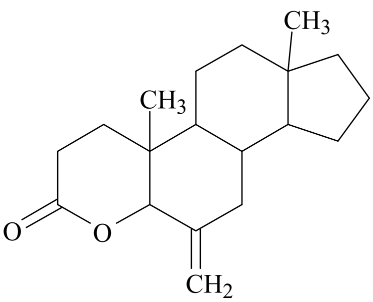
(a) 

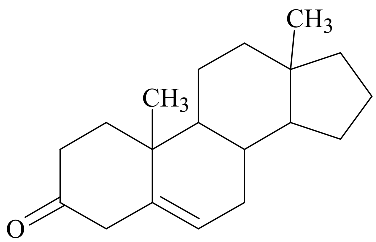
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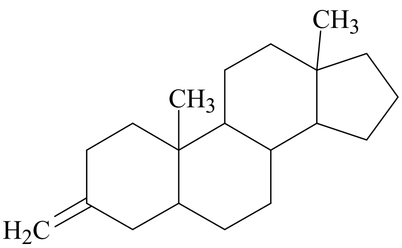
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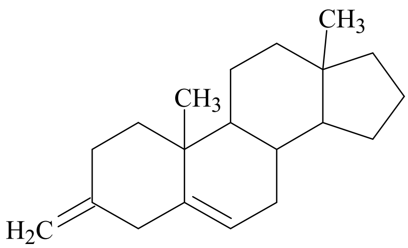
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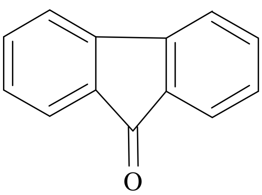
60.  Identify product?

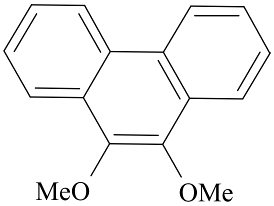
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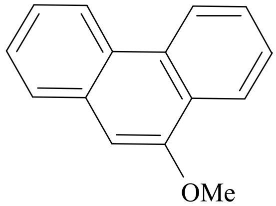
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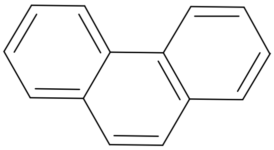
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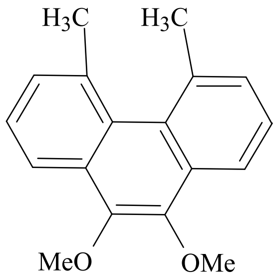
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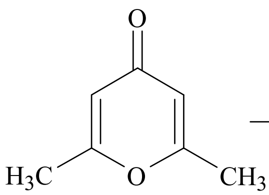
61.  (i) CH_2N_2 (ii) NaH (iii) MeI → Identify product?

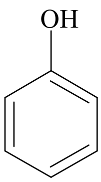
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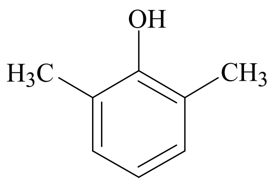
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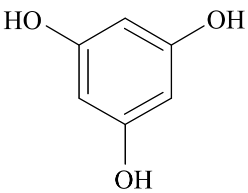
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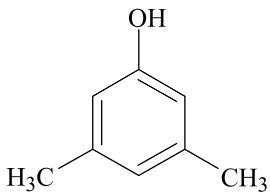
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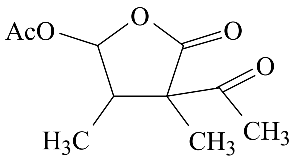
62.  (i) MeMgCl (ii) $HClO_4$ (aq.) (iii) NaOH (aq.) → Identify product?

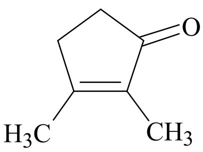
(a) 

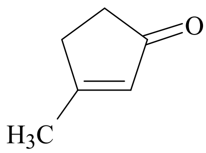
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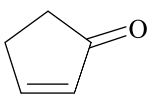
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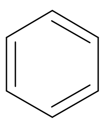
(d) 

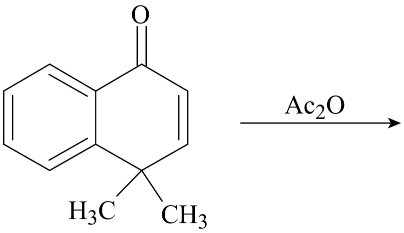
63.  Aq. NaOH /Δ → Identify product?

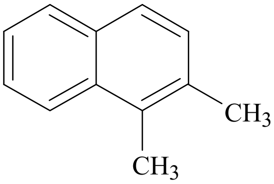
(a) 

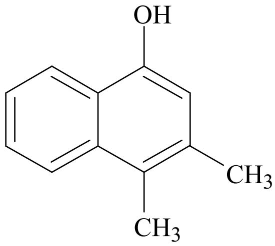
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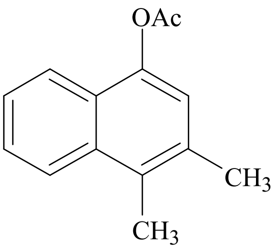
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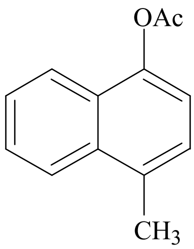
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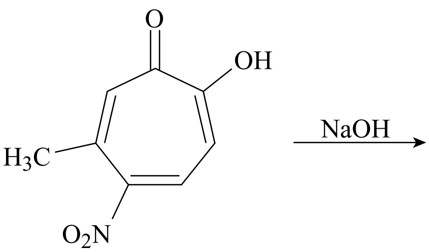
64.  Identify product?

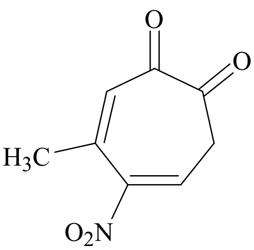
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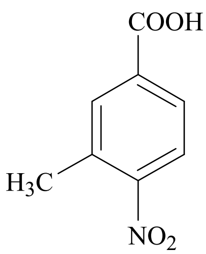
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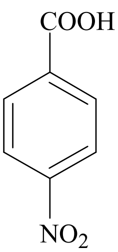
(c) 

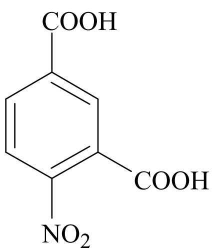
(d) 

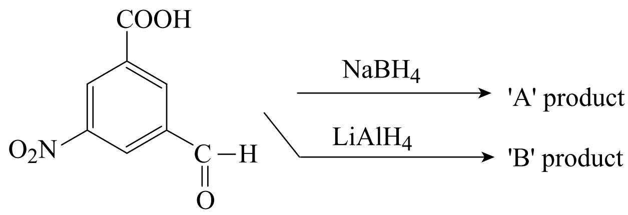
65.  Identify product?

(a) 

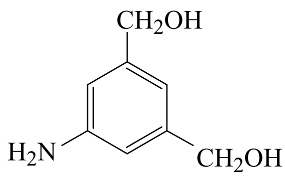
(b) 

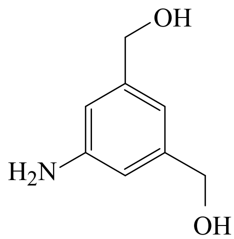
(c) 

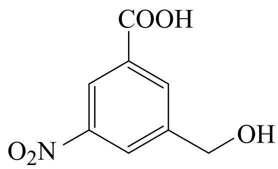
(d) 

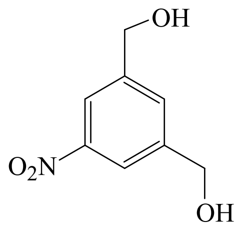
66. 

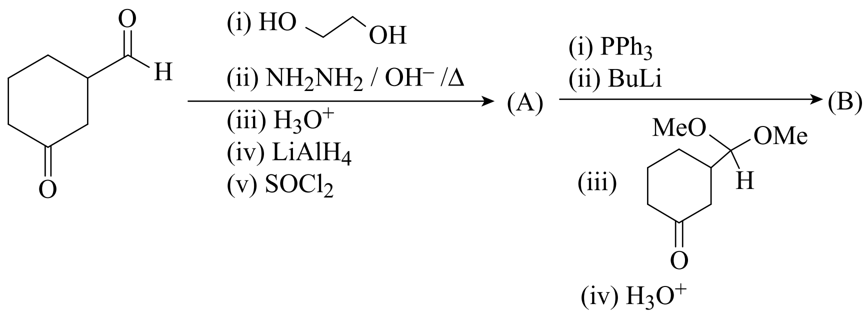
Identity true statement for A and B products.

(a) 'A' is 

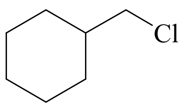
(b) 'B' is 

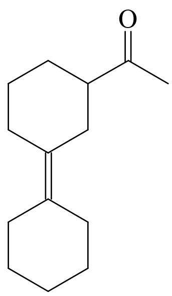
(c) 'A' is 

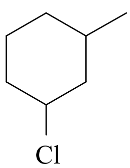
(d) 'B' is 

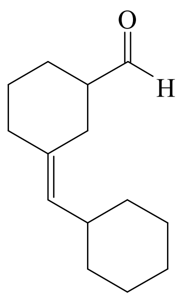
67. 

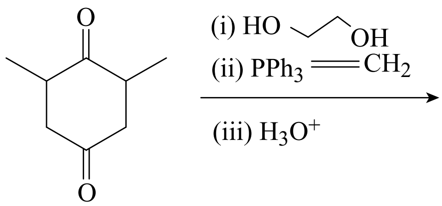
Identify correct statement for (A) and (B) products.

(a) Structure of 'A' is 

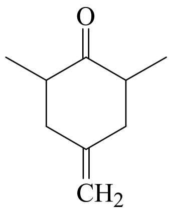
(b) Structure of 'B' is 

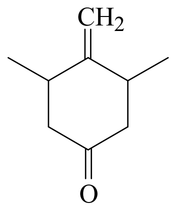
(c) Structure of 'A' is 

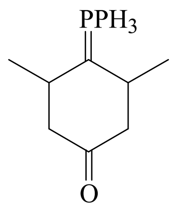
(d) Structure of 'B' is 

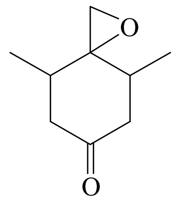
68. 

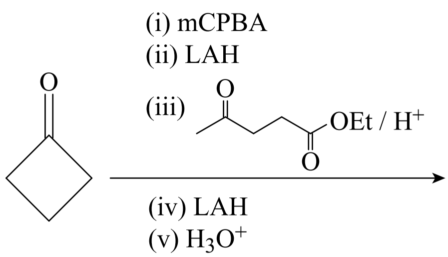
Major product is?

(a) 

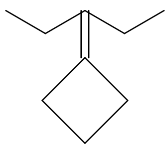
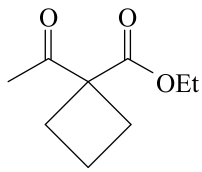
(b) 

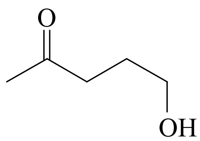
(c) 

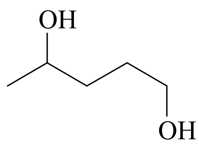
(d) 

69. 

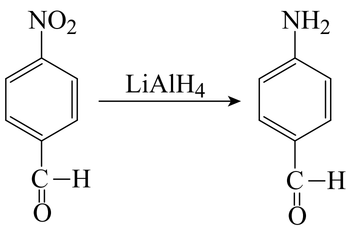
Major product is?

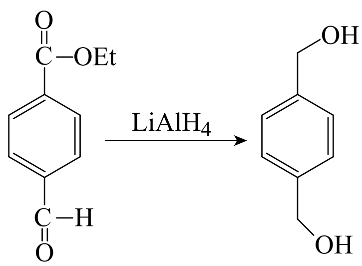
(a) 
(b) 

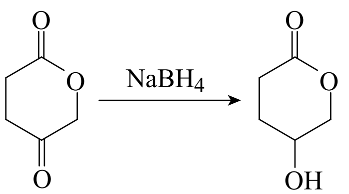
(c) 

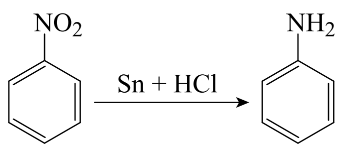
(d) 

70. Identify correct reaction sequence

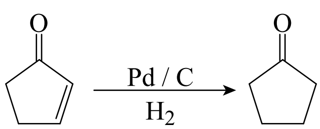
(a) 

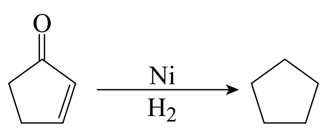
(b) 

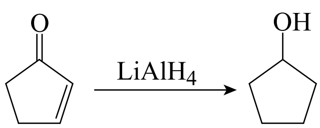
(c) 

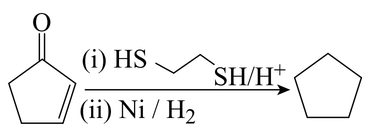
(d) 

71. Identify correct reaction sequence

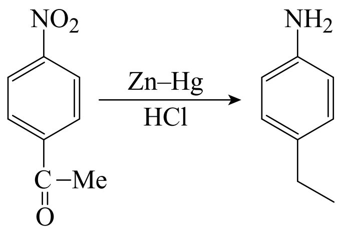
(a) 

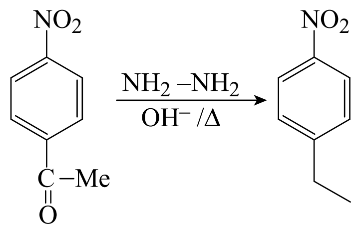
(b) 

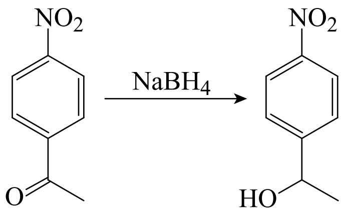
(c) 

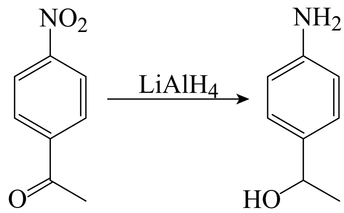
(d) 

72. Identify correct reaction sequence

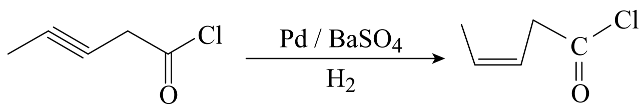
(a) 

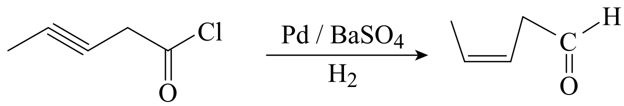
(b) 

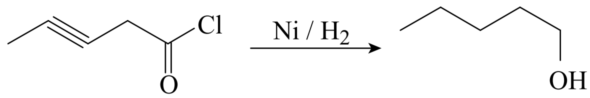
(c) 

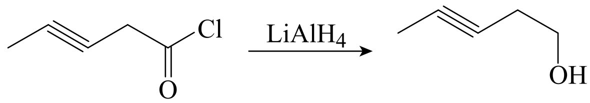
(d) 

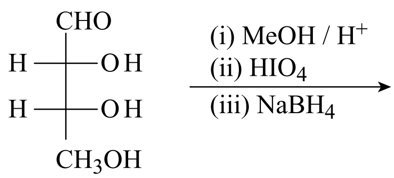
73. Identify correct reaction sequence

(a) 

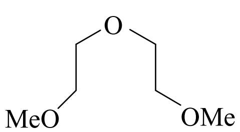
(b) 

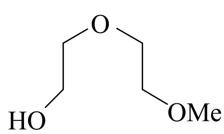
(c) 

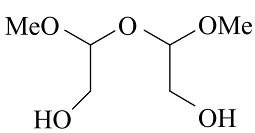
(d) 

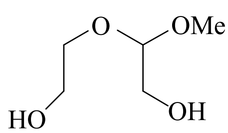
74. 

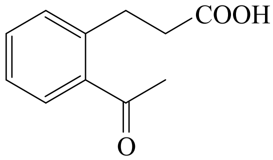
Major product is?

(a) 

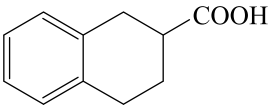
(b) 

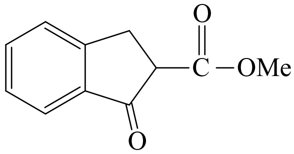
(c) 

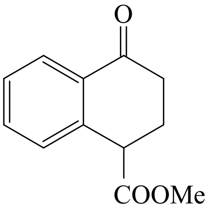
(d) 

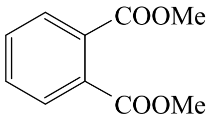
75. 

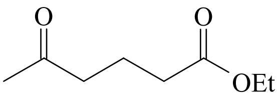
(i) Br_2, NaOH
(ii) MeOH / H^+
(iii) NaOMe
→ Major product is?

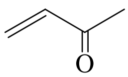
(a) 

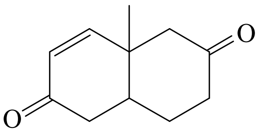
(b) 

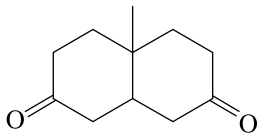
(c) 

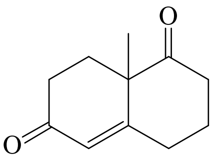
(d) 

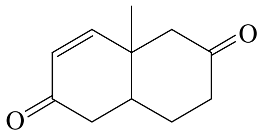
76. 

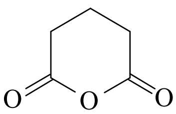
(i) 2 eq. NaOEt
(ii) Me–I
(iii)  Cat. NaOEt /Δ
→ Major product is?

(a) 

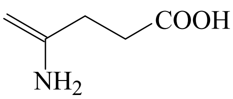
(b) 

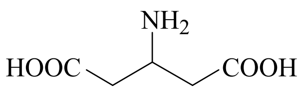
(c) 

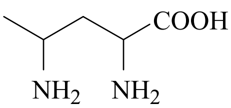
(d) 

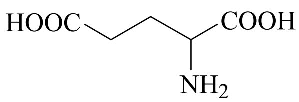
77. 

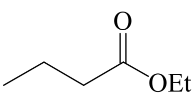
(i) MeOH
(ii) Red P + Br_2
(iii) NH_3 (excess)
(iv) H_3O^+
→ Major product is?

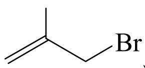
(a) 

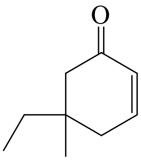
(b) 

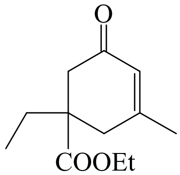
(c) 

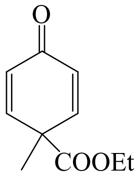
(d) 

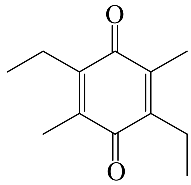
78. 

(i) 2 eq. LDA
(ii) 2 eq. 
(iii) O_3 / Zn
(iv) OH^- /Δ
→ Major product is?

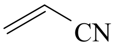
(a) 

(b) 

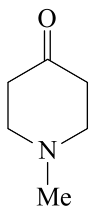
(c) 

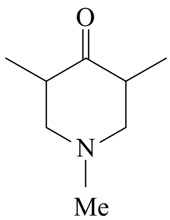
(d) 

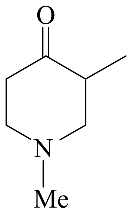
79. Me —— NH_2 $\xrightarrow{}$ Major product is?

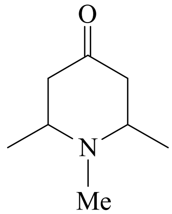
(i) 2eq. 

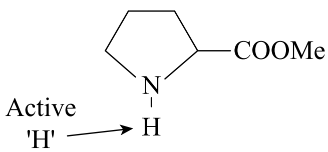
(ii) H_3O^+
(iii) MeOH / H^+
(iv) NaOMe / MeOH
(v) H_3O^+ /Δ

(a) 

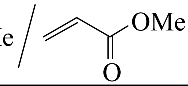
(b) 

(c) 

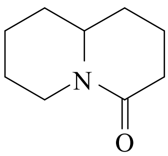
(d) 

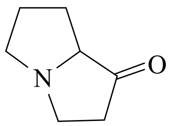
80. 

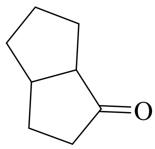
$\xrightarrow{}$ Major product is?

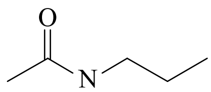
(i) NaOMe / 

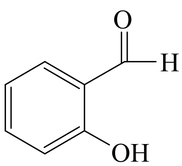
(ii) Aq. NaOH
(iii) H^+ /Δ($CO_2\uparrow$)

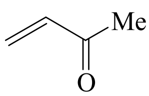
(a) 

(b) 

(c) 

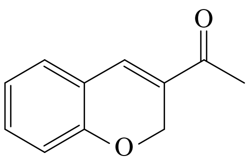
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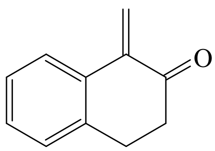
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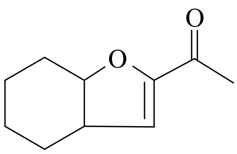
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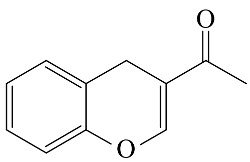
$\xrightarrow[\Delta]{OH^-}$ Major product is?

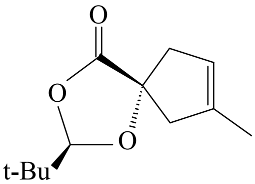
[Intramolecular aldol]

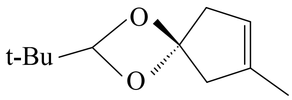
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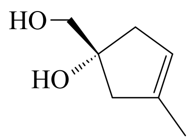
(b) 

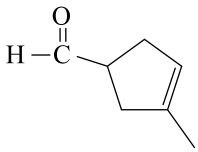
(c) 

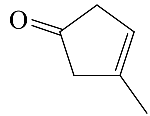
(d) 

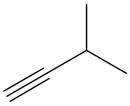
82.  $\xrightarrow{\text{LAH}}$ Major product is?

(a) 

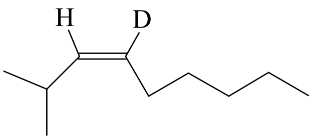
(b) 

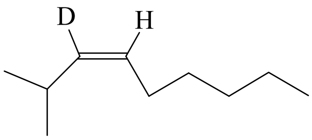
(c) 

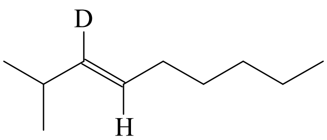
(d) 

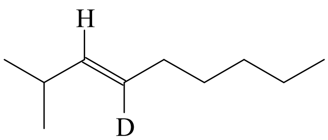
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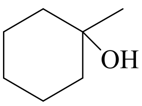
(i) LDA
(ii) 1-Bromopentane
(iii) BH_3^- THF
(iv) MeCOOD
→ Major product is?

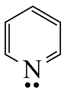
(a) 

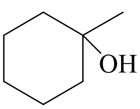
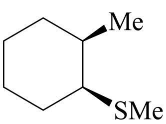
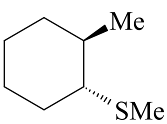
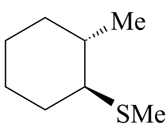
(b) 

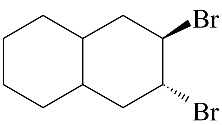
(c) 

(d) 

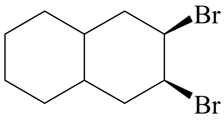
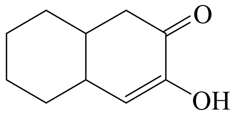
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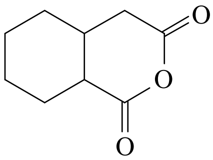
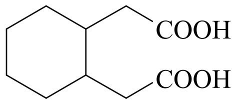
(i) H_3PO_4 /Δ
(ii) BH_3 – THF
(iii) H_2O_2 / OH
(iv) $SOCl_2$ 
(v) NaSMe
→ Major product is?

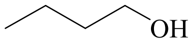
(a)  (b)  (c)  (d) 

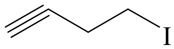
85. 

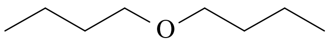
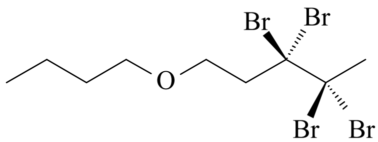
(i) 2 eq. $NaNH_2$
(ii) Pd / $BaSO_4$ / H_2
(iii) OsO_4, then $NaHSO_3$
(iv) HIO_4
(v) H_2CrO_4
→ Major product is?

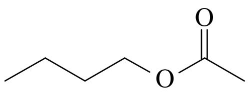
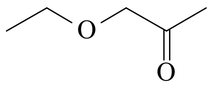
(a) 
(b) 

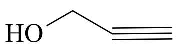
(c) 
(d) 

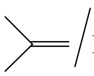
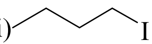
86.  $\xrightarrow{}$ Major product is?

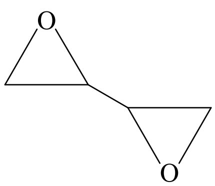
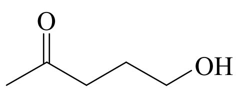
(i) BuLi
(ii) 
(iii) $NaNH_2$
(iv) CH_3–I
(v) Br_2 / CCl_4

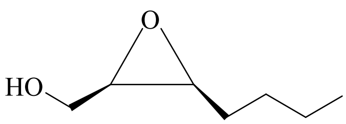
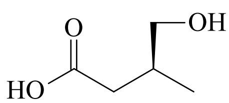
(a) 
(b) 

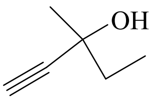
(c) 
(d) 

87.  $\xrightarrow{}$ Major product is?

(i)  / H_2SO_4
(ii) $NaNH_2$
(iii) 
(iv) H_3O^+
(v) H_2 / Lindlar's catalyst
(vi) m·CPBA

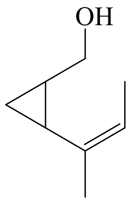
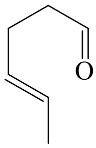
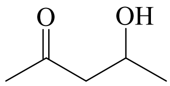
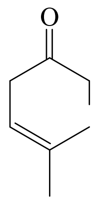
(a) 
(b) 

(c) 
(d) 

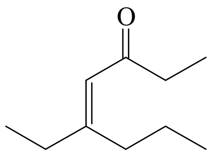
88. 

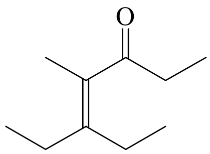
(i) Conc. nH_2SO_4 / Δ
(ii) BuLi / $H-\overset{O}{\overset{\|}{C}}-H$
(iii) Pd / $BaSO_4$ / H_2
(iv) Zn–Cu / CH_2I_2 ether

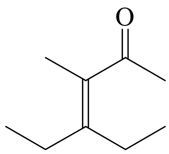
→ Major product is?

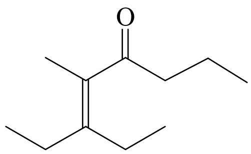
(a)  (b)  (c)  (d) 

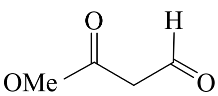
89. Which of the following structures is the product from the self-condensation of two molecules of pentan-3-one?

(a) 

(b) 

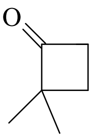
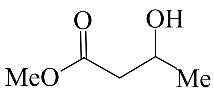
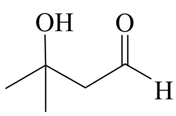
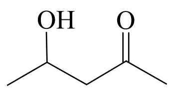
(c) 

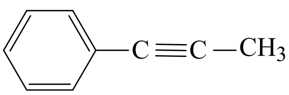
(d) 

90. 

(i) HO–$(CH_2)_2$–OH, H^+
(ii) Excess MeMgBr, then H_3O^+

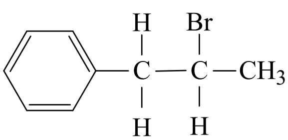
→ Major product is?

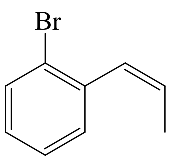
(a)  (b)  (c)  (d) 

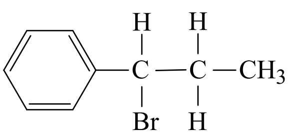
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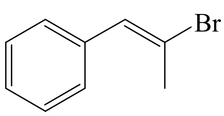
(i) Na, NH_3
(ii) HBr

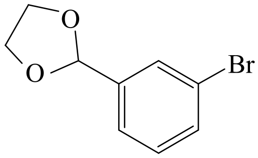
→ Major product is?

(a) 

(b) 

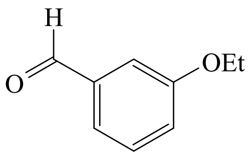
(c) 

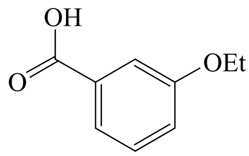
(d) 

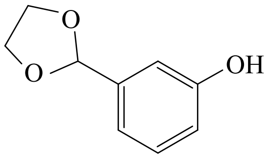
92. 

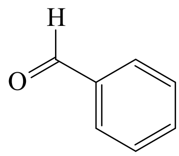
(i) Mg, Ether
(ii) EtOH
(iii) Catalytic H^+, H_2O

Major product is?

(a) 

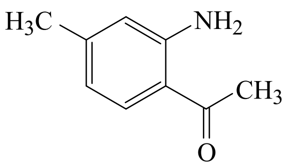
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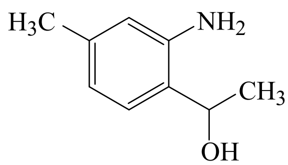
(c) 

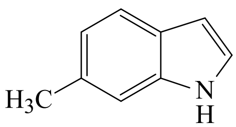
(d) 

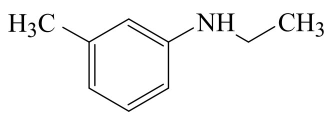
93. Select all of the following statements about the cross Aldol experiment that are true:
(a) The ketone was added to a solution containing the aldehyde and base.
(b) The reaction can be catalyzed by an acid.
(c) The electrophile is the enolate ion.
(d) The aldehyde is used in excess.

94. CH_3CO_2H $\xrightarrow[\text{(ii) 3-Methylaniline; (iii) LiAlH}_4\text{, then H}_3\text{O}^+]{\text{(i) SOCl}_2}$ Major product is?

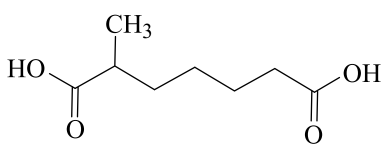
(a) 

(b) 

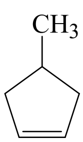
(c) 

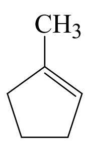
(d) 

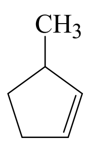
95. (i) O_3, then Zn in H_2O
(ii) $NaBH_4$
(iii) Excess PBr_3
(iv) Excess KCN
(v) H^+, H_2O, Heat

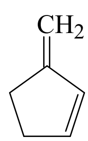


Identify reactant?

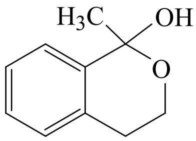
(a) 

(b) 

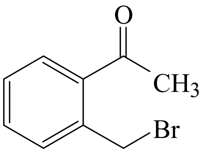
(c) 

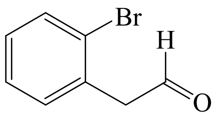
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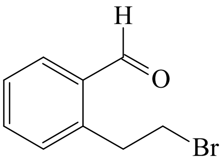
96. (i) HO–CH_2CH_2–OH, Catalytic H^+ ⟶ (ii) Mg, THF then H_2O=O, then H_3O^+ (iii) H_3O^+, heat

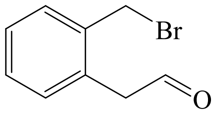


Identify reactant?

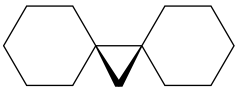
(a) 

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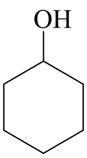
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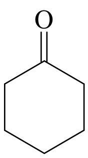
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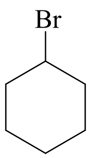
97. (i) Ph_3P, then n-BuLi ⟶ (ii) Cyclohexanone (iii) CH_2I_2, Zn–Cu

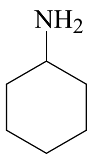


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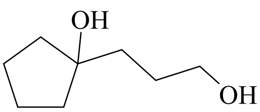
(a) 

(b) 

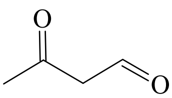
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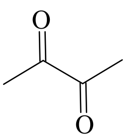
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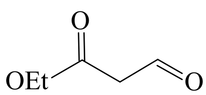
98. BrMg–$(CH_2)_4$–MgBr ⟶ then, H_3O^+

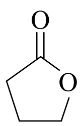


Identify reactant?

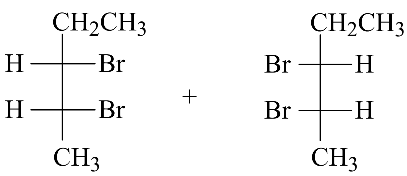
(a) 

(b) 

(c) 

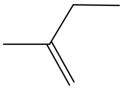
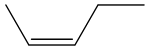
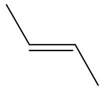
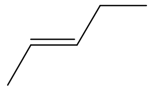
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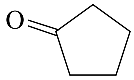
99. ⟶ Br_2

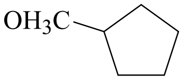


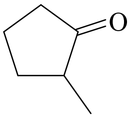
(50:50 of these enantiomers)

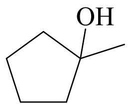
Identify reactant?

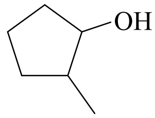
(a)  (b)  (c)  (d) 

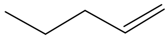
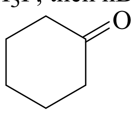
100.  (i) LDA (ii) CH_3I (iii) $NaBH_4/MeOH$ → Major product is?

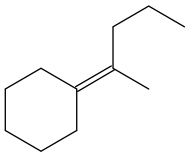
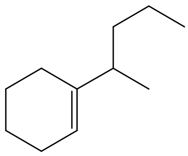
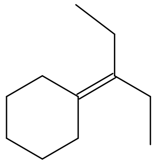
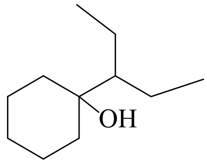
(a) 

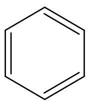
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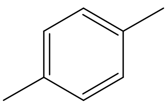
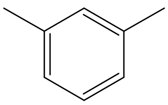
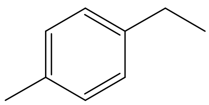
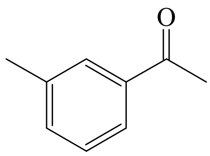
(c) 

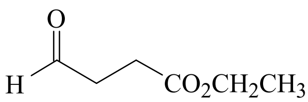
(d) 

101.  (i) HBr (dark, N_2) (ii) PH_3P, then nBuLi (iii)  Major product is?

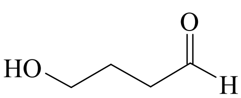
(a)  (b)  (c)  (d) 

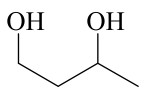
102.  (i) $(CH_3CO)_2O/AlCl_3$ (ii) Zn/Hg HCl (iii) $CH_3Cl/\ AlCl_3$ → Major product is?

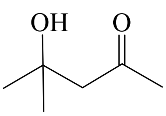
(a)  (b)  (c)  (d) 

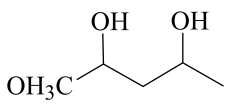
103. 

(i) $HOCH_2CH_2OH/H^+$/heat (ii) $LiAlH_4$, then H_3O^+ (iii) H_3O^+ / heat → Major product is?

(a) 

(b) 

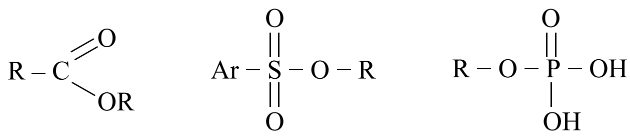
(c) 

(d) 

Comprehension Type

Passage 1

When the following three different types of esters are hydrolyzed in a basic medium,



Carboxylate Sulphonate Phosphate

the hydroxide anion attacks the acyl carbon in carboxylates while it attacks the alkyl carbon in sulphonates leading to a difference in the site of cleavage. More interestingly, phosphate esters lie somewhat in between carboxylates and sulphonates in that cleavage can occur in either direction.

In an acidic solution, all the three types of phosphates (monoalkyl, dialkyl and trialkyl) are hydrolyzed to phosphoric acid, while in a basic solution only trialkyl phosphates undergo hydrolysis and only one alkoxy group is removed.

104. Which of the following factor explains the difference in attack of the nucleophile, OH^- on carboxylates and sulphonates?

(a) Sulphonate anions are weakly basic and hence good leaving groups.

(b) Carboxylate anions are strongly basic and hence poor leaving groups.

(c) Both (a) and (b)

(d) None of the these

105. Competition between phosphorus and alkyl carbon to nucleophilic attack is due to the fact that

(a) Phosphorus can accept an additional pair of electrons.

(b) Phosphoric acid lies between carboxylic acid and sulphonic acid.

(c) Both (a) and (b)

(d) None of the these

106. The rate of hydrolysis of monoalkyl phosphates tends to .... with increase in pH.

(a) Decrease (b) Increase

(c) Remains unaffected (d) None of these

107. In an aqueous solution, a monoalkylphosphate ester can exist as

(a) A neutral ester

(b) A monoanion and dianion

(c) A monoanion, dianion and protonated ester

(d) A monoanion, dianion, protonated ester and neutral ester

Passage 2

Grignard reagents (RMgX) are prepared by the reaction of an organic halide and magnesium metal is in ether solvent.

$$\text{R–X} + \text{Mg} \xrightarrow{\text{R–O–R}} \text{R–MgX}$$

The solvent (usually diethyl ether or tetrahydrofuran) plays a crucial role in the formation of a Grignard reagent. Alkyl halides are more reactive than aryl and vinyl halides. Indeed, aryl and vinyl chlorides do not form Grignard reagent in diethyl ether.

However, an alkyl halide containing an alcoholic –OH group can be converted to Grignard reagent by first protecting the –OH group to tert–butyldimethylsilyl ether which is inert to Grignard reagent. The protecting group is finally liberated by treatment with fluoride ion.

$$\text{R}-\text{O}-\text{H} + \text{Cl}\,\underset{\text{CH}_3}{\overset{\text{CH}_3}{\text{Si}}}-\text{C(CH}_3)_3 \longrightarrow \text{R}-\text{O}-\underset{\text{CH}_3}{\overset{\text{CH}_3}{\text{Si}}}-\text{C(CH}_3)_3$$

tert–butylchlorodimethylsilane

$$\xrightarrow[\text{THF}]{(\text{C}_4\text{H}_9)_4\text{N}^+\text{F}^-} \text{R}-\text{O}-\text{H} + \text{F}-\underset{\text{CH}_3}{\overset{\text{CH}_3}{\text{Si}}}-\text{C(CH}_3)_3$$

108. Grignard reactions generally occur in dry ether because

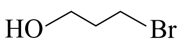
(a) The stronger acid diethyl ether will displace the weaker RH acid from its salt.

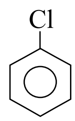
(b) The stronger acid H_2O will displace the weaker acid RH from its salt.

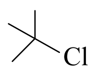
(c) Water slows down the reaction.

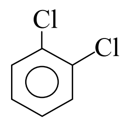
(d) Water mixes with ether preventing ether to perform its function.

109. Grignard reagent cannot be prepared from

(a) 

(b) 

(c) 

(d) 

110. $H_2N(CH_2)_3Br$ cannot be converted into corresponding Grignard reagent because of

(a) Reaction between $–NH_2$ and –Br groups present in the same molecule

(b) Strong nucleophilic character of the Grignard reagent

(c) Strong basic nature of the Grignard reagent

(d) All the three factors

111. The function of tetrahydrofuran in the preparation of Grignard reagent is that it

(a) Acts as a solvent

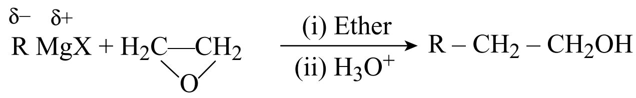
(b) Helps in maintaning the reactivity of magnesium

(c) Both (a) and (b)

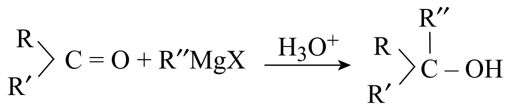
(d) None of the these

Passage 3

Grignard reagents are powerful nucleophiles and strong bases. They act as nucleophiles by attacking a variety of compounds including saturated and unsaturated carbon atoms. Examples of reaction on saturated carbon include oxiranes (epoxides) which form alcohols as the final product.



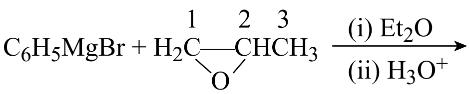
Examples of reaction on unsaturated carbon are attack on $>C=O$, $-C\equiv N$, $>C=S$, etc.



When R and R′ = H, product is 1° alcohol.

When R and R′ = Alkyl group, product is 3° alcohol.

When one R or R′ is alkyl, product is 2° alcohol.

112.  Product.

Here, the nucleophile $C_6H_5^-$ attacks

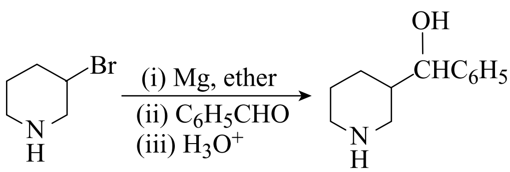
(a) C_1 (b) C_2 (c) C_3 (d) Any of the three

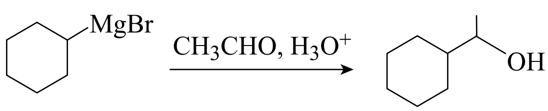
113. Epoxides react with Grignard reagent to form

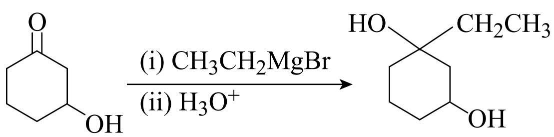
(a) Primary alcohols (b) Secondary alcohols

(c) Tertiary alcohols (d) Any of the three

114. On the basis of the above two passages, predict which of the reaction is feasible.

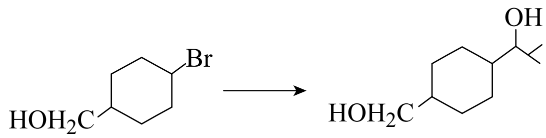
(i) 

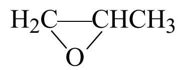
(ii) 

(iii) 

(a) Only ii (b) i and ii (c) All the three (d) None of three

115. On the basis of the above two passages, steps involved in the following conversion are



(a) Protection of the –OH group, followed by reaction with 

(b) Protection of the –OH group, followed by reaction with CH_3CH_2CHO

(c) Protection of the –OH group, followed by reaction with $(CH_3)_2CHCHO$

(d) Reaction is not feasible to give quantitative yield

Passage 4

Alkyl halides and alcohols easily undergo nucleophilic substitution either through S_N1 or S_N2 mechanism. The relative case of these two processes depends upon the nature of the substrate (alkyl group as well as leaving group), nature of nucleophile and also upon the nature of solvent.

S_N1 mechanism involves the formation of carbocation as intermediate while S_N2 mechanism involves the formation of a transition pentavalent state. S_N1 is the main mechanism in 3° alkyl halides and alcohols, while S_N2 mechanism is the path adopted by most of the 1° alkyl halides and 2° alkyl halides may follow S_N1 as well as S_N2.

116. Which of the following solvent will give maximum yield for an alkyl halide undergoing S_N1 mechanism?

(a) Water (b) Ethanol (c) Diethyl ether (d) n-hexane

117. Rearrangement of alkyl groups occur when hydrogen halides react with alcohols except with most primary alcohols. The best explanation is that

(a) The 1° carbocations are unstable and hence are not formed.

(b) The 1° carbocations are unable to undergo rearrangement.

(c) Both (a) and (b) are true

(d) Both (a) and (b) are false

118. Neopentyl alcohol, Me_3CCH_2OH, reacts with HX according to

(a) S_N1 mechanism (b) S_N2 mechanism

(c) Both (a) and (b) (d) None

Passage 5

119. A chemist treated a compound X with NaOH in presence of acetone as solvent. However, he recovered the starting material as such, and instead isolated a small amount of the product A. The product A was shown to have C, H and O and it had a molecular weight of 116g/mol. It gave a positive iodoform test and was found to be identical with a compound obtained by the aldol self-condensation of acetone.

Although the product A did not discharge colour of bromine in CCl_4, its dehydration product B with hot sulphuric acid discharged bromine dissolved in CCl_4.

120. What is the molecular weight of a compound that undergoes an aldol self-condensation reaction and whose dehydrated product has a molecular weight of 70?

(a) 35 (b) 44 (c) 49 (d) 58

121. The aldol self-condensation of acetone is in equilibrium that favours acetone over its corresponding product. Which of the following conditions is most likely to shift the position of equilibrium toward product A?

(a) By using a catalytic amount of NaOH.
(b) By using only a catalytic amount of acetone.
(c) By removing product A as soon as it is formed.
(d) By increasing reaction temperature.

122. Which of the following compounds will give a positive iodoform test?

(a) Only compound A (b) Only compound B
(c) Both (a) and (b) (d) None of these

123. The compound X can be

(a) $CH_3\overset{O}{\overset{||}{C}}H$ (b) $CH_3-\overset{O}{\overset{||}{C}}-CH_3$
(c) HCHO (d) n–$CH_3CH_2CH_2CH_3$

Passage 6

Amides undergo hydrolysis to yield carboxylic acid plus amine on heating in either aqueous acid or aqueous base. The conditions required for amide hydrolysis are more severe than those required for the hydrolysis of esters, anhydrides or acid chlorides, but the mechanism is similar (nucleophilic acyl substitution). Nucleophilic acyl substitutions involve a tetrahedral intermediate, hence these are quite different from alkyl substitution ($RCH_2Br \xrightarrow{NaCN} RCH_2CN$) which involves a pentavalent intermediate or transition state.

One of the important reactions of esters is their reaction with two equivalent of a Grignard reagent to give tertiary alcohols.

124. The mechanism involved during the hydrolysis of acid derivatives is

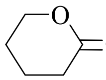
(a) elimination-addition (b) addition-elimination
(c) nucleophilic addition-elimination (d) electrophilic addition-elimination

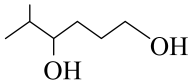
125. Which of the following constitutes the best substrate during the acidic hydrolysis of amides?

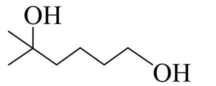
(a) $R-\overset{O}{\overset{||}{C}}-NH_2$ (b) $R-\overset{O}{\overset{||}{C}}-\overset{+}{N}H_3$ (c) $R-\overset{OH^+}{\overset{||}{C}}-NH_2$ (d) $R-\overset{OH^+}{\overset{||}{C}}-\overset{+}{N}H_3$

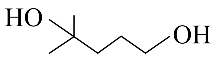
126. For which functional derivative of carboxylic acids, acidic hydrolysis is avoided?

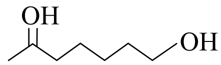
(a) Acid chlorides (b) Acid amides
(c) Acid anhydrides (d) Esters

127. When  is treated with two equivalent of methyl magnesium iodide, the product that acidified the final product will be

(a) 

(b) 

(c) 

(d) 

128. Which of the following methods is more general for preparing nitriles?

(a) $RCH_2Br + NaCN \longrightarrow RCH_2CN + NaBr$

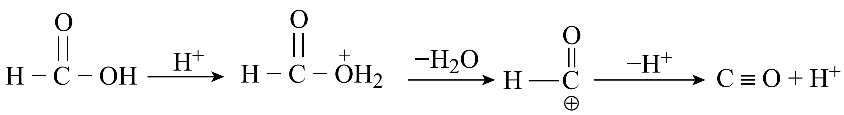
(b) $RCH_2CH_2CONH_2 \xrightarrow{P_4O_{10}} RCH_2CH_2CN$

(c) Both (a) and (b)

(d) None of these

Passage 7

Methanoic acid, the first member of carboxylic acid series, when warmed with concentrated sulphuric acid decompose in the following way and evolve carbon monoxide



The driving force for this reaction lies in the fact that the $HC \equiv O^+$ ion is very unstable acid and thus easily loses H^+.

129. Formic acid on heating with conc. H_2SO_4 gives

(a) $CO_2 + H_2$ (b) $CO + H_2O$ (c) CO (d) H_2O

130. What happens when acetic acid is treated with conc. H_2SO_4?

(a) $CO + H_2O$ (b) $CH_4 + CO_2$ (c) $CO + CH_4$ (d) No reaction

131. If acetic acid is replaced by triphenylacetic acid, the product formed will be

(a) $(C_6H_5)_3CH + CO$

(b) $(C_6H_5)_3CH + CO_2$

(c) $(C_6H_5)_3COH + CO$

(d) No reaction

132. If formic acid is replaced by benzoylformic acid, $C_6H_5COCOOH$, the product formed will be

(a) $C_6H_5COOH + CO + CO_2$

(b) $C_6H_5COOH + CO_2$

(c) $C_6H_5COOH + CO$

(d) $C_6H_5CHO + CO_2$

Answer Keys

LEVEL 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
d	a	c	d	b	b	a	d	d	d	d	a	c	a	a	a	b	b	d	a
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
c	b	d	b	a	d	c	b	d	b	b	b	b	c	d	c	a	d	b	c
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
c	c	d	d	b	b	c	c	c	d	c	c	d	d	c	c	c	c	b	b
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
c	a	a	c	b	c	d	b	c	a	c	c	c	b	d	c	c	b	c	c
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
c	d	b	d	c	b	a	c	c	b	a	d	b	d	a	b	d	b	b	d
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
c	a	a	c	b	d	b	b	a	d	d	a	a	d	b	d	c	c	d	c
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
d	a	b	d	b	d	b	c	c	d	b	d	d	c	a	a	c	a	d	a
141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
a	d	b	d	c	a	d	c	b	b	c	c	d	d	b	d	b	a	b	b
161	162	163	164	165	166	167	168	169	170										
b	d	b	d	d	c	d	a	c	c										

LEVEL 2

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
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d	c	a	b	a	b	b	c	c	c	a	b	a	b	b
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
d	b	b	c	d	c	a	a	c	d	b	a	a	b	b
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
b	d	a	c	b	bc	ad	b	c	bcd	ad	abcd	bcd	d	b
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
c	d	b	a	b	a	b	a	cd	d	b	c	a	b	c
91	92	93	94	95	96	97	98	99	100	1 01	1 02	1 03	1 04	105
c	d	abd	d	b	a	c	d	d	d	a	c	a	c	a
106	1 07	108	1 09	110	111	112	113	114	115	116	117	118	119	120
a	d	b	a	c	c	a	d	d	d	a	d	a	b	c
121	1 22	123	124	125	126	127	128	129	130	131	132			
c	d	c	c	c	b	b	b	b	c	c	c			

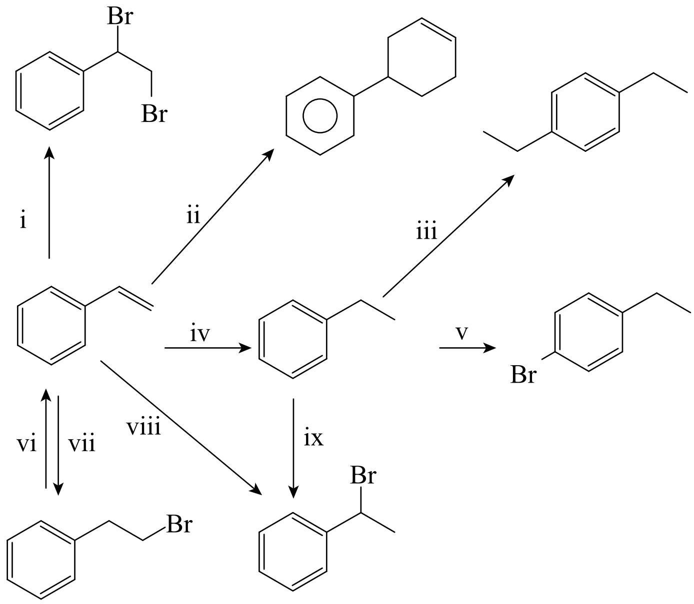
WORKBOOK EXERCISES

EXERCISE 1

Matrix Type

Identify reagents (1 to 9) used in the following conversion from reagent present in the second Column II (A to L).

Column I (Conversion)



Column II (Reagent)

(A) Br_2

(B) NaBr / acetone

(C) Br_2 / UV light

(D) Br_2 / $FeBr_3$

(E) HBr / dark

(F) HBr / light

(G) EtBr

(H) EtBr / $AlCl_3$

(I) KOH / EtOH / Δ

(J) $CH_2CHCHCH_2$ / Δ

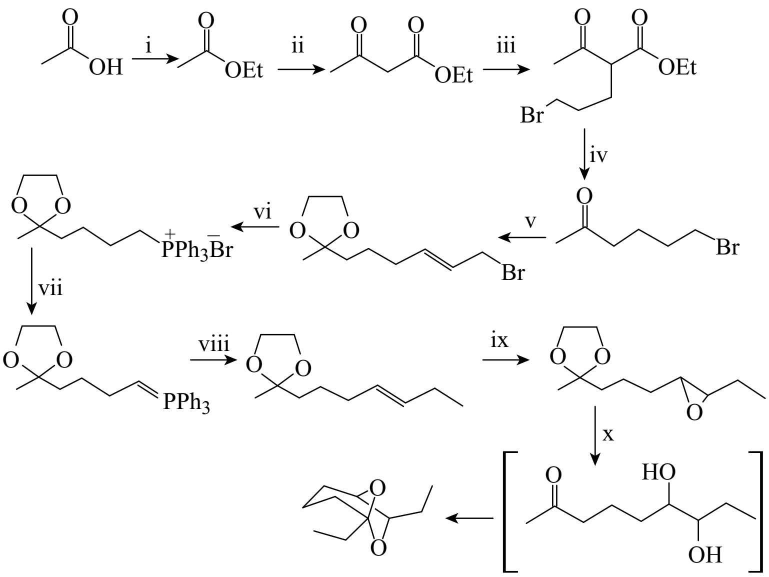
(K) H_2SO_4

(L) H_2 /Pd

EXERCISE 2

Identify reagents (1 to 10) used in the following conversion from reagent present in the second Column II (A to P).

Column I (Conversion)



Brevicomin

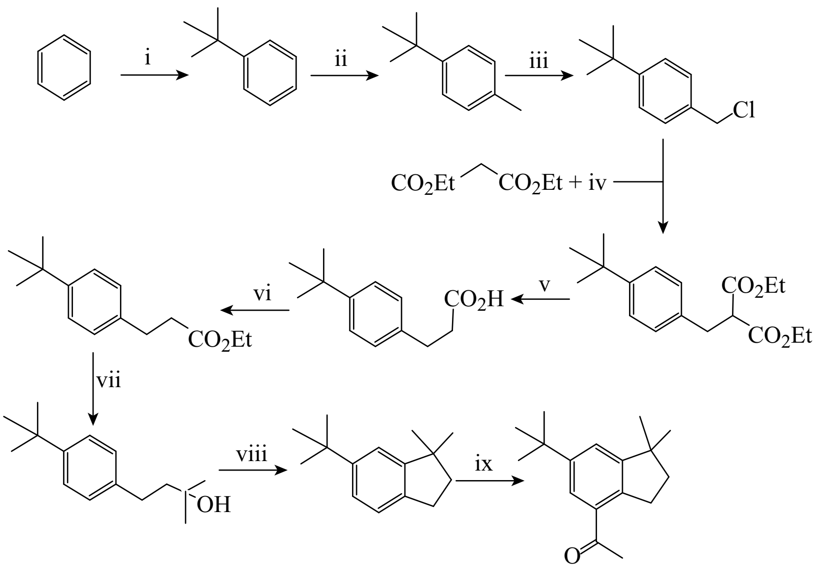
Column II (Reagent)

(A) $CH_3CH_2CH_2CH_2Li$ / THF
(B) $CH_3CH{=}CH_2$
(C) CH_3CO_2H
(D) CH_3CO_3H
(E) $(CH_3)_2C{=}O/H^+$
(F) CH_3CH_2CHO
(G) PBr_3 / Et_3N
(H) PPh_3
(I) $CH_3CH_2CH_2MgBr$ / THF, then H_3O^+
(J) H_3O+ / Δ
(K) Conc. H_2SO_4 / Δ
(L) NaOEt, then $Br(CH_2)_3Br$
(M) NaOEt / EtOH
(N) $LiAlH_4$, then H_3O^+
(O) $HOCH_2CH_2OH/H^+$
(P) EtOH /H^+ / heat

EXERCISE 3

Identify reagents (1 to 9) used in the following conversion from reagent present in the second Column II (A to S).

Column I (Conversion)



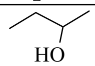
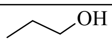
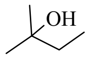
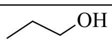
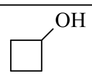
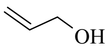
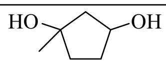
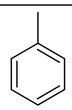
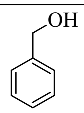
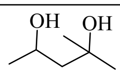
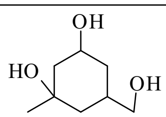
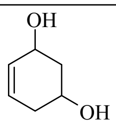
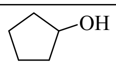
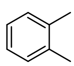
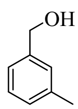
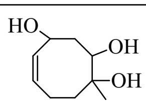
Column II (Reagent)

(A) $KOH / H_2O / H_3O^+ / \Delta$
(B) NaOEt / EtOH
(C) CH_3ONa / CH_3OH
(D) CH_3CH_2OH / H^+
(E) CH_3OH / H^+
(F) Excess CH_3I
(G) Conc. H_2SO_4
(H) BH_3, then aq. NaOH / H_2O_2
(I) $CH_3Cl / AlCl_3$
(J) $CH_3COCl / AlCl_3$
(K) Excess CH_3MgI, then H_3O^+
(L) Conc. HCl
(M) NCS or Cl_2
(N) $LiAlH_4$, then H_3O^+
(O) $NaBH_4$
(P) $Ph_3P{=}CH_2$
(Q) tBuOH / H^+
(R) tBuCl / KOH
(S) $H_2O / HgSO_4 / H_2SO_4$

EXERCISE 4

Identify products in the following matrix.

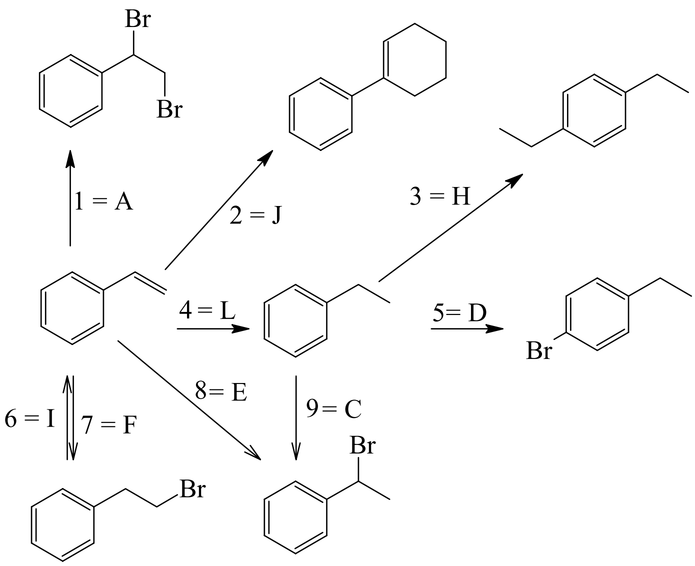
Reagents ⟶

Compounds	PCC	$K_2Cr_2O_7$	NaH/MeI	MnO_2	Conc. $KMnO_4$
					
					
					
					
					
					
					
					
					
					
					
					
					
					
					
					

SOLUTION FOR WORKBOOK EXERCISES

EXERCISE 1

Column I (Conversion) **Column II (Reagent)**



(A) Br_2

(B) NaBr / acetone

(C) Br_2 / uv light

(D) Br_2 / $FeBr_3$

(E) HBr / dark

(F).HBr / light

(G) EtBr

(H) EtBr / $AlCl_3$

(I) KOH / EtOH/Δ

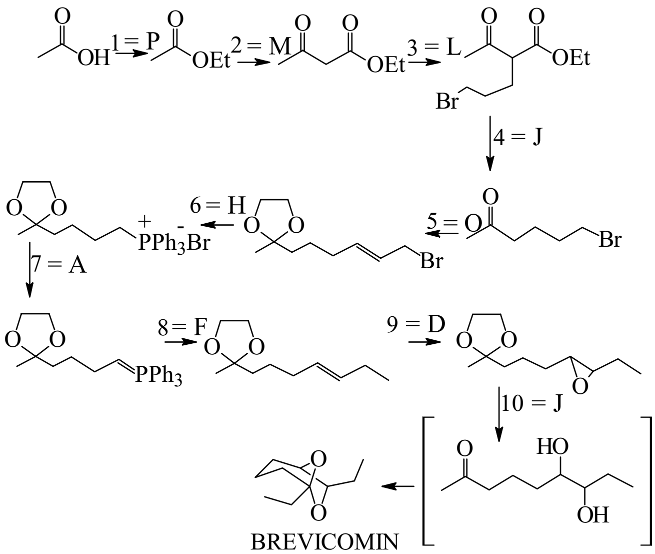
(J) $CH_2CHCHCH_2$/Δ

(K) H_2SO_4

(L) H_2 /Pd

EXERCISE 2

Column I (Conversion)

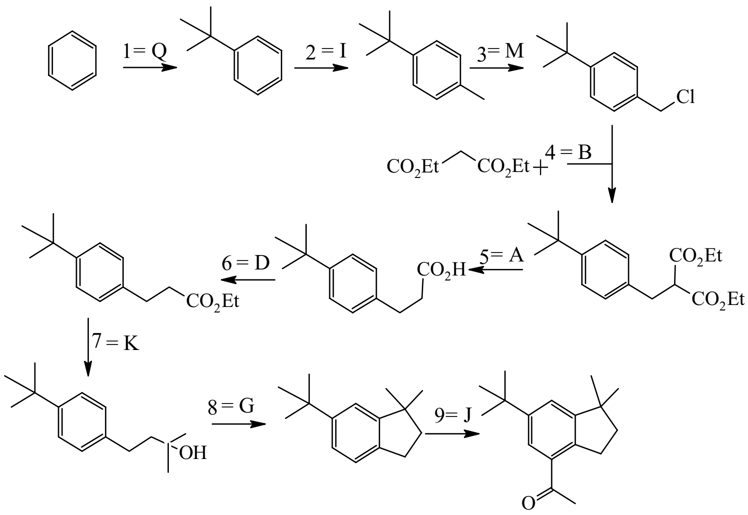


Column II (Reagent)

(A) $CH_3CH_2CH_2CH_2Li$ / THF
(B) $CH_3CH{=}CH_2$
(C) CH_3CO_2H
(D) CH_3CO_3H
(E) $(CH_3)_2C{=}O/H^+$
(F) CH_3CH_2CHO
(G) PBr_3 / Et_3N
(H) PPh_3
(I) $CH_3CH_2CH_2MgBr$ / THF then H_3O^+
(J) H_3O^+ / D
(K) Conc. H_2SO_4 /D
(L) NaOEt then $Br(CH_2)_3Br$
(M) NaOEt / EtOH
(N) $LiAlH_4$ then H_3O^+
(O) $HOCH_2CH_2OH/H^+$
(P) EtOH /H^+ / heat

EXERCISE 3

Column I (Conversion)



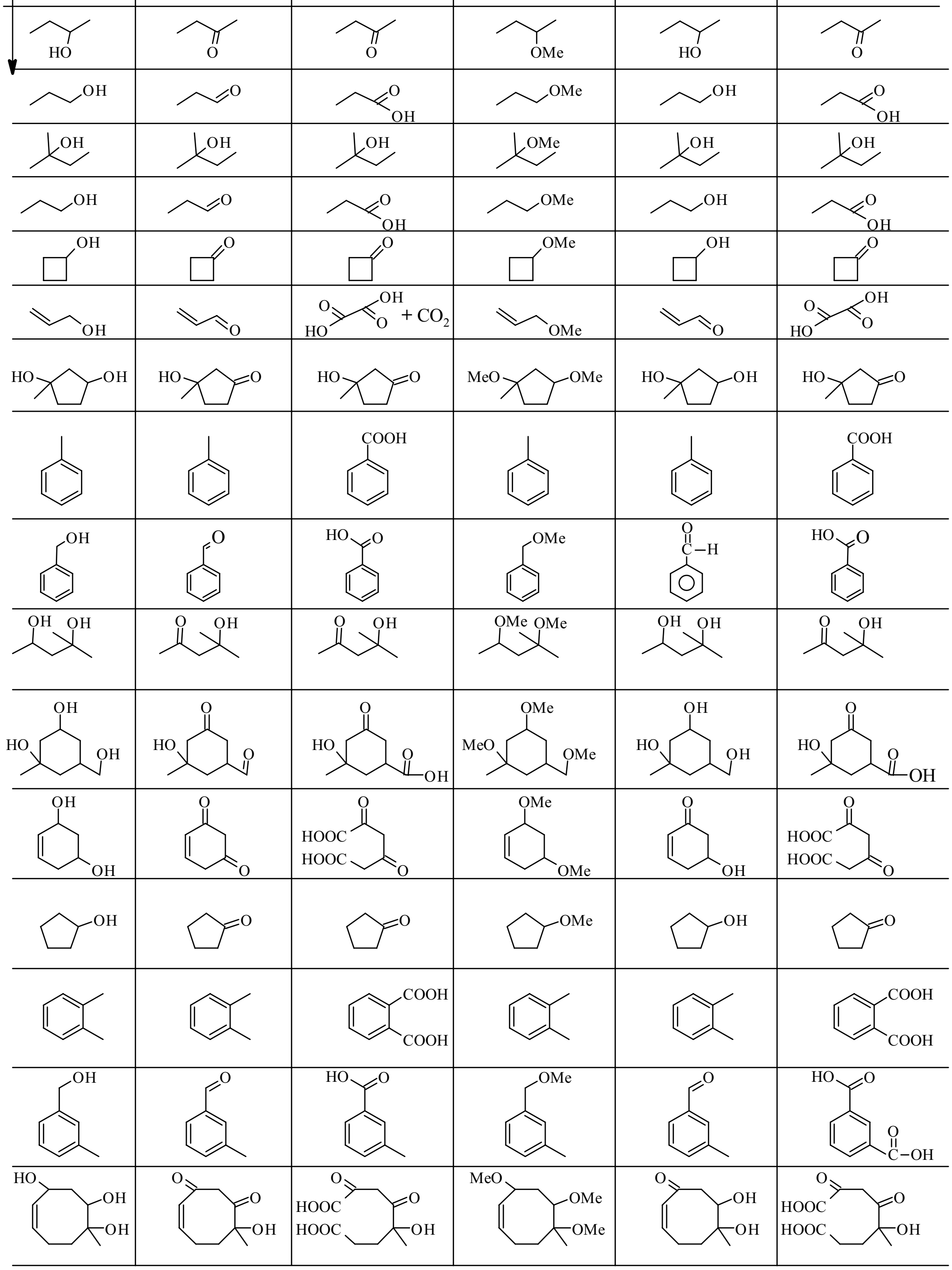
Column II (Reagent)

(A) KOH / H_2O / Δ
(B) NaOEt / EtOH
(C) CH_3ONa / CH_3OH
(D) CH_3CH_2OH / H^+
(E) CH_3OH / H^+
(F) Excess CH_3I
(G) conc. H_2SO_4
(H). BH_3 then aq. NaOH / H_2O_2
(I) CH_3Cl / $AlCl_3$
(J) CH_3COCl / $AlCl_3$
(K) excess CH_3MgI then H_3O^+
(L) conc. HCl
(M) NCS or Cl_2
(N) $LiAlH_4$ then H_3O^+
(O) $NaBH_4$
(P) $Ph_3P{=}CH_2$
(Q) tBuOH / H^+
(R) tBuCl / KOH
(S) H_2O / $HgSO_4$ / H_2SO_4

EXERCISE 4

Reagents →

Compounds ↓	PCC	$K_2Cr_2O_7$	NaH/MeI	MnO_2	Conc.$KMnO_4$



CHAPTER 9

Practical Organic Chemistry

Question Bank

LEVEL 1

1. Sodium nitroprusside $Na_2[Fe(CN)_5NO]$ is used as reagent for detection of _____ and the compound formed is ____.

(a) Sulphur, $Na_4[Fe(CN)_5NOS]$ (b) Nitrogen, $Na_4[Fe(CN)_6]$

(c) Sulphur, $Na_2[Fe(CN)_4NOS]$ (d) Sulphur, $Na_2[Fe(CN)_5NOS]$

2. The prussian blue colouration obtained in the test for nitrogen in the organic compound is

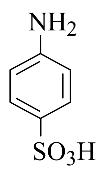
(a) $K_4[Fe(CN)]_6$ (b) $Fe_4[Fe(CN)_6]_3$ (c) $Fe[Fe(CN)_6]$ (d) $Fe_3[Fe(CN)_6]_2$

3. If N and S both are present in an organic compound during Lassaigne's test, both will change into

(a) Na_2S and NaCN (b) NaSCN

(c) Na_2SO_3 and NaCN (d) Na_2S and NaCNO

4. Which of the following will not give test for 'N' in sodium extract?

(a) $C_6H_5NHNH_2$ (b) NH_2CONH_2 (c) $NH_2–NH_2$ (d) 

5. Which of the following will be blood red colour with $FeCl_3$ in sodium extract (Lassaigne extract)?

(a) NH_2CONH_2 (b) NH_2CSNH_2 (c) $C_6H_5NHNH_2$ (d) $CH_3C≡N$

6. A mixture of acetone and CCl_4 can be separated by
(a) Azeotropic distillation (b) Fractional distillation
(c) Steam distillation (d) vacuum distillation

7. Phenol and benzoic acid can be separated by
(a) $NaHCO_3$ (b) NaOH solution
(c) $FeCl_3$ solution (d) All of these

8. Anthracene can be purified by
(a) Distillation (b) Sublimation
(c) Filtration (d) Fractional distillation

9. KOH can be used as a drying agent for
(a) amines (b) phenols (c) acids (d) esters

10. Silver salt method is used to determine molecular weight of
(a) organic acids (b) organic bases
(c) both acids and bases (d) none of these

11. Which of the following observations is correct and is used in the identification of carboxylic acids?
(a) Carboxylic acids liberate CO_2 gas from $NaHCO_3$ solution.
(b) They produce fruity smell of esters when heated with alcohol in presence of Conc. H_2SO_4.
(c) Both (a) and (b)
(d) Iodoform test

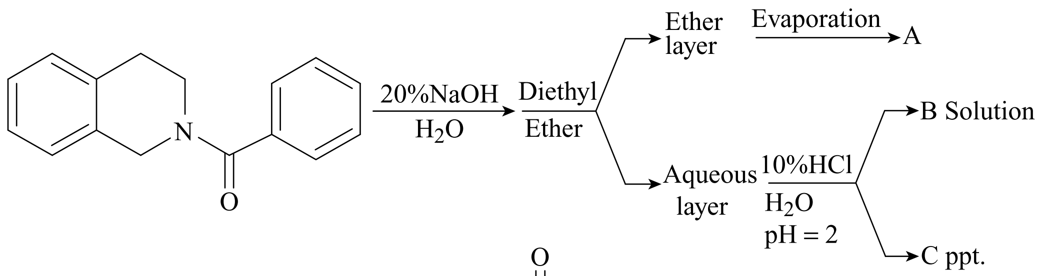
12. An organic compound is heated with HNO_2 at 0°C and then the resulting solution is added to a solution of β-naphthol whereby a brilliant red dye is produced. The observations indicate that the compound possesses
(a) $-NO_2$ group (b) $-CONH_2$ group
(c) aromatic NH_2 group (d) aliphatic NH_2 group

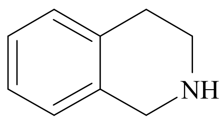
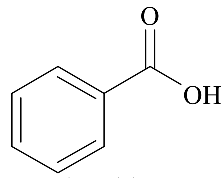
13. An organic compound contains C, H, N, S and Cl. For the detection of chlorine, the sodium extarct of the compound is first heated with a few drops of concentrated HNO_3 and then $AgNO_3$ is added to get a white ppt. of AgCl. The digestion with HNO_3 before the addition of $AgNO_3$ is
(a) to prevent the formation of NO_2
(b) to create a common ion effect
(c) to convert CN^- and S^{2-} to volatile HCN and H_2S, or else they will interfere with the test forming AgCN or Ag_2S
(d) to prevent the hydrolysis of NaCN and Na_2S

14. Rectified spirit contains
(a) 95.6 per cent ethanol and 4.4 per cent methanol
(b) 100 per cent ethanol
(c) 95.6 per cent ethanol and 4.4 per cent water
(d) 95.6 per cent ethanol and 4.4 per cent benzene

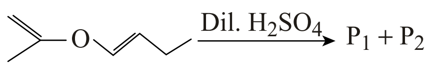
15. Aniline can be separated from phenol using
(a) $NaHCO_3$ (b) $NaNO_2$ + HCl at 0°C
(c) NaCl (d) Acidified $KMnO_4$

16. Identify correct statement for A, B and C in the following sequence.



where  and 

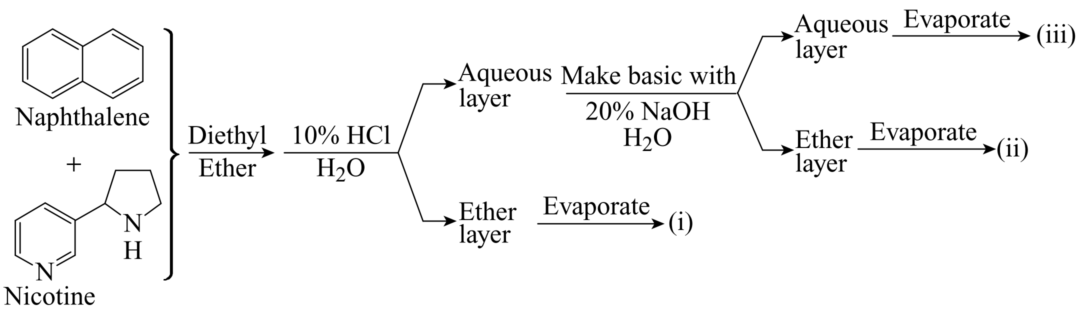
(a) A = benzoic acid, B = sodium chloride and C = isoquinoline
(b) A = isoquinoline, B = benzoic acid and C = sodium chloride
(c) A = isoquinoline, B = sodium chloride and C = benzoic acid
(d) A = sodium chloride, B = isoquinoline and C = benzoic acid

17. 

P_1 and P_2 products are identify by

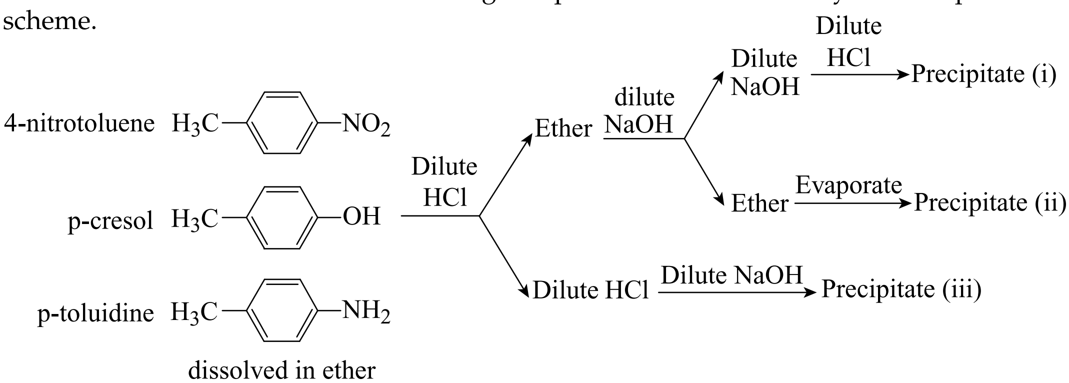
(a) Tollen's reagent
(b) Iodoform test
(c) $Br_2 + H_2O$ test
(d) 1 per cent alkaline $KMnO_4$

18. In the following extraction procedure, choose the number where nicotine would be found.



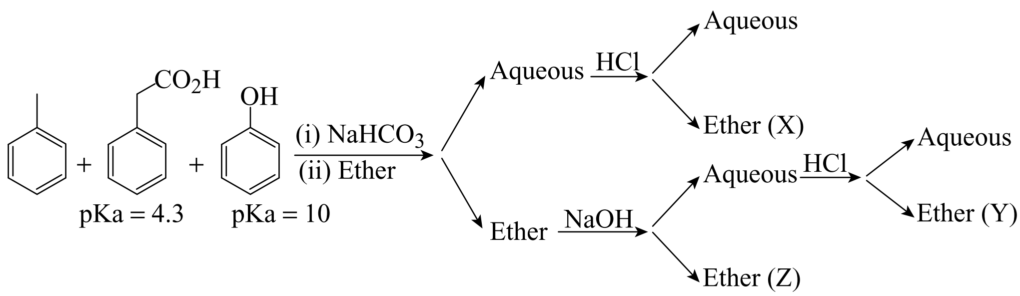
(a) i = Nicotine
(b) i + iii = Nicotine
(c) ii = Nicotine
(d) ii + iii = Nicotine

19. Choose the answer that has the following compounds located correctly in the separation scheme.



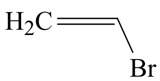
(a) i = 4-nitrotoluene, ii = p-cresol, iii = p-toluidine
(b) i = 4-nitrotoluene, ii = p-toluidine, iii = p-cresol
(c) i = p-toluidine, ii = 4-nitrotoluene, iii = p-cresol
(d) i = p-cresol, ii = 4-nitrotoluene, iii = p-toluidine

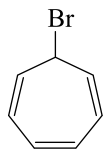
20. Choose the answer that has the following compounds located correctly in the separation scheme.

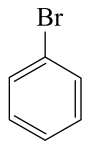


(a) toluene is in (Y); phenylacetic acid is in (Y); phenol is in (Z)
(b) toluene is in (Y); phenylacetic acid is in (X); phenol is in (Z)
(c) toluene is in (Z); phenylacetic acid is in (Y); phenol is in (X)
(d) toluene is in (Z); phenylacetic acid is in (X); phenol is in (Y)

21. Among the following which compound gives precipitate with $AgNO_3$ solution?

(a) 

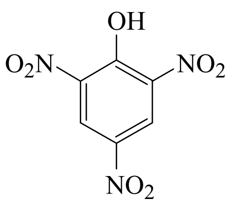
(b) 

(c) 

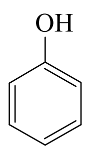
(d) None of these

22. Disodium pentacyanonitrosyl ferrate reagent gives purple colour when which of the following element is present?
(a) N (b) Cl (c) F (d) S

23. Which of the following compound can liberate CO_2 when treated with $NaHCO_3$?

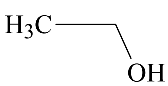
(a) 

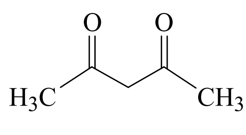
(b) CH_3CO_2H

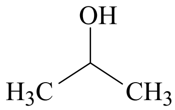
(c) HCO_2H
(d) 

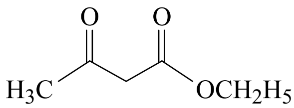
24. Phenol + Phthalic anhydride $\xrightarrow[\text{fusion}]{\text{Conc. } H_2SO_4}$ B. B gives which of the following colour in alkaline medium?
(a) Yellow (b) Colourless (c) Pink (d) Violet

25. Among the following, which will respond to iodoform test?

(a) 

(b) 

(c) 

(d) 

26. Among the following, which statement is not correct?

(a) $H_3C-\overset{\overset{\displaystyle O}{||}}{C}-OH$ will not respond to haloform test

(b) Schiff 's regent and Schiff 's base are different compounds

(c) Fehling's solution is a good reagent to detect aromatic aldehydes

(d) Both aldehyde and ketone can react with 2, 4-dinitrophenylhydrazise reagent

27. To separate a mixture of amines from each other, one should follow

(a) Beckmann's method (b) Hinsberg's method

(c) Zeisel's method (d) Victor Meyer's Method

28. Phenol can be distiguished from ethanol by

(a) Tollen's reagent (b) Benedict's reagent

(c) $FeCl_3$ (d) Schiff 's base

29. p-Cl — $C_6H_4NH_2$ and $PhNH_3{}^+Cl^-$ can be distinguished by

(a) NaOH (b) $AgNO_2$ (c) $LiAlH_4$ (d) Zn

LEVEL 2

Single and Multiple-choice Type

1. In Lassaigne's test, the organic compound is first fused with sodium metal. The sodium metal is used because
   (a) The melting point of sodium metal is low.
   (b) Sodium metal reacts with elements present in organic compounds to form inorganic compounds.
   (c) All sodium salts are soluble in water.
   (d) All sodium salts are not soluble in water.

2. Molecular weight of acids can be detemined by
   (a) Silver salt method (b) Volumetric method
   (c) Plants chloride method (d) Victor Meyer's method

3. Ethanol and ethanal are distinguished by
   (a) Fehling's solution test (b) Tollen's reagent test
   (c) Iodoform test (d) Cerric ammonium nitrate

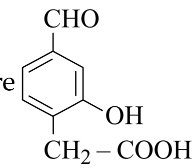
4. Which of the following statements are correct?
   (a) An organic compound is pure if mixed melting point is same.
   (b) Ethanol and water can be separated by azeotropic distillation because it forms azeotrope.
   (c) Impure aniline is purified by steam distillation as it is steam volatile.
   (d) Glycerol is purified by vaccuum distillation because it decomposes at its normal boiling point.

5. Which of the following will respond to iodoform test?
   (a) $CH_3-\overset{\underset{||}{O}}{C}-COOH$ (b) $CH_3-\overset{\underset{|}{OH}}{CH}-COOH$
   (c) $CH_3-\overset{\underset{|}{OH}}{CH}-CH_3$ (d) CH_3CH_2OH

6. Which of the following will not show iodoform test?
   (a) $CH_3-\overset{\underset{||}{O}}{C}-CH_3$ (b) $CH_3-\overset{\underset{||}{O}}{C}-Cl$ (c) $CH_3-\overset{\underset{||}{O}}{C}-NH_2$ (d) CH_3–COOH

7. HCOOH and CH_3COOH can be distinguished by
   (a) Tollen's reagent (b) Fehling's solution
   (c) $KMnO_4$ (d) $NaHCO_3$

8. The desiccants used for absorbing water during Liebig's method for estimation of carbon and hydrogen are
   (a) anhydrous $CaCl_2$ (b) anhydrous Na_2SO_4
   (c) $Mg(ClO_4)_2$ (d) $MgSO_4\cdot 7H_2O$

9. An organic compound has the structure 

. It will give

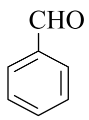
(a) cerric ammonium nitrate test
(b) brick effervescence with sodium bicarbonate
(c) a characteristic colouration with neutral ferric chloride after decarboxylation and reduction by Clemenson's method
(d) Fehling's test

10. Which of the following organic compounds will give white precipitate with $AgNO_3$?
(a) $C_6H_5NH_3^+Cl^-$ (b) NaCl
(c) 2,4,6-trinitro chlorobenzene (d) Benzyl chloride

11. Which of the following reactions occur during the detection of nitrogen in organic substances by Lassaigne's test?
(a) $Na + C + N \longrightarrow NaCN$
(b) $FeSO_4 + 6NaCN \longrightarrow Na_4[Fe(CN)_6] + Na_2SO_4$
(c) $3Na_4[Fe(CN)_6] + 2Fe_2(SO_4)_3 \longrightarrow Fe_4[Fe(CN)_6]_3 + 6Na_2SO_4$
(d) None of these

12. Compound A reacts with $CHCl_3$ and KOH and gives an offensive smelling compound. A can be
(a) Primary aliphatic amine (b) Primary aromatic amine
(c) Secondary amine (d) Tertiary amine

13. HCOOH and HCHO may be distinguished by
(a) Tollen's test (b) Sodium bicarbonate test
(c) 2,4-DNP test (d) Benedict's test

14. 

and CH_3CHO can be distinguished by

(a) Tollen's test (b) Benedict's test (c) Iodoform test (d) 2,4-DNP test

15. Acetic acid and CH_3COCl can be distinguished by
(a) $NaHCO_3$ test (b) Na metal test
(c) Ester formation test (d) Br_2(aq.) test

Comprehension Type

Passage 1

Steam distillation is used to purify a compound which is steam volatile and insoluble in water. The impurities should not be steam volatile. It is based on the principle that liquid will boil when partial vapour pressure of liquid and partial vapour pressure of steam both become equal to atmospheric pressure, $P = p_1 + p_2$. It reduces the boiling point of a liquid.

$$\frac{\text{Weight of water distilled}}{\text{Wt. of substance distilled}} = \frac{\text{M. Wt. of water} \times \text{VP of steam}}{\text{M. Wt. of substance} \times \text{VP of aniline}}$$

16. Isolation of essential oils from flowers, etc. is done by
(a) Steam disitllation
(b) Distillation
(c) Fractional distillation
(d) Distillation under reduced pressure

17. Which of the following is steam volatile?
(a) o-nitrophenol (b) p-nitrophenol
(c) p-hydroxy benzaldehyde (d) Ethanol

18. Calculate weight of aniline distilled if weight of water distilled is 100 g when $P_{\text{organic compound}} = 100$ mm and $P_{H_2O} = 200$ mm.
(a) 250 g (b) 258 g (c) 100 g (d) 25.8 g

19. Steam distillation is based on
(a) Dalton's law of partial pressures
(b) Graham's law of diffusion
(c) Raoult's law of non-volatile solute
(d) None of these

20. Which of the following cannot be separated by steam distillation?
(a) Nitrobenzene (b) Essential oil (c) Aniline (d) Glycerol

Passage 2

Test (Q). A compound X was fused with Na metal and the extract gave a white precipitate with $AgNO_3$. The Lassaigne's extract gave a red colouration with neutral $FeCl_3$.

Test (R). While compound Y when fused with Na metal and subsequent analysis on its Lassaigne's extract did not give any characteristic test.

Test (S). While compound Y on fusion with fusion mixture (sodium carbonate + potassium nitrate) or Na_2O_2, followed by extraction, followed by addition of Conc. HNO_3 and ammonium molybdate gave a yellow precipitate.

21. Compound X contains
(a) N (b) S (c) N + S (d) P

22. Compound X
(a) will contain halogens (b) may contain halogens
(c) may contain only sulphur (d) will contain only nitrogen

23. Compound Y contain
(a) N (b) S (c) X (d) P

24. The chemical reaction taking place in Y, when it is fused with fusion mixture is
(a) $3Na + P + 4O \longrightarrow Na_3PO_4$
(b) $3Na_2CO_3 + 2P + [O] \longrightarrow 2Na_3PO_4 + 3CO_2$
(c) $3KNO_3 + P + 3O \longrightarrow K_3PO_4 + 3NO_2 + O_2$
(d) None of these

25. The formula of yellow precipitate is
(a) $(NH_4)_3PO_4$ (b) $Mo(PO_4)$
(c) $(NH_4)_3PO_4 \cdot 12Mo_3O_3$ (d) $Mo(PO_4)_2$

Passage 3

The 0.2 g of anhydrous organic acid gave on combustion 0.04 g of water and 0.195 g of CO_2. The acid is a dibasic acid and 0.5 g of its silver salt leaves on ignition 0.355 g of silver.

26. The percentage of carbon in the compound is
(a) 50 (b) 52 (c) 26.6 (d) 90

27. The percentage of hydrogen in the compound is
(a) 5.6 (b) 2.22 (c) 4.44 (d) 10

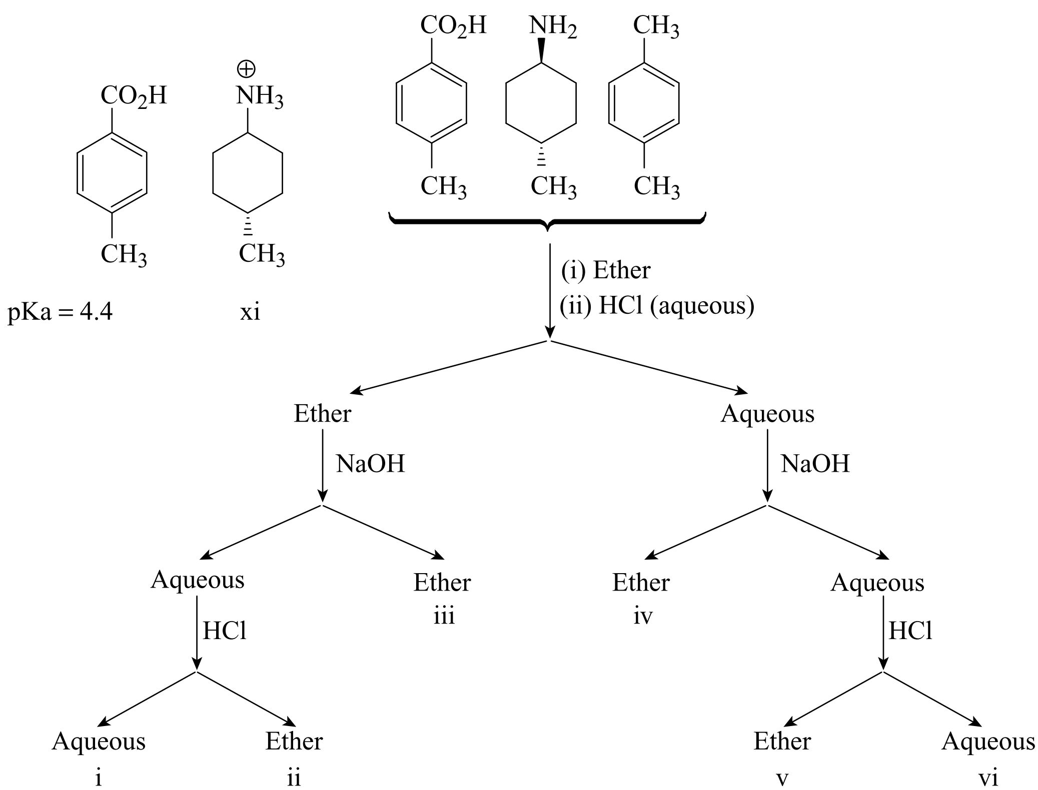
28. The empirical weight of the compound is
(a) 90 (b) 100 (c) 10 (d) 45

29. The molecular weight of the compound is
(a) 90 (b) 100 (c) 10 (d) 45

30. The molecular formula of the compound is
(a) CHO (b) CHO_2 (c) $C_2H_2O_4$ (d) $C_3H_6O_2$

Passage 4

A student in a lab had a mixture of three compounds, 4-methylbenzoic acid, 4-methylcyclohexylamine and 1,4-dimethylbenzene. In order to separate the three compounds the following extraction (separation) scheme was followed. At the end of the procedure the student had six separate flasks containing either an aqueous or an ether solution. Locate each compound by designating the flask expected to contain each compound. Some relevant pK_a data is given.



31. Which flask contains the 4-methylcyclohexylamine?
(a) 1 (b) 2 (c) 3 (d) 4

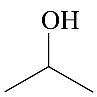
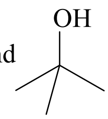
32. Which flask contains the 4-methylbenzoic acid?
(a) 1 (b) 2 (c) 3 (d) 4

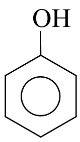
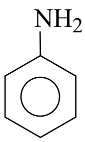
33. Which flask contains the 1,4-dimethylbenzene?
(a) 1 (b) 2 (c) 3 (d) 4

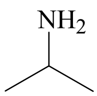
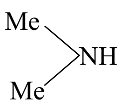
Matrix Type

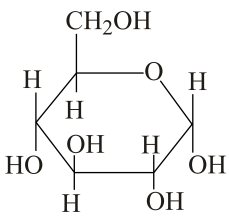
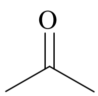
Match the columns:

34. Column I (pair of compounds)

(a)  and 

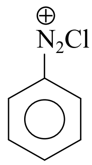
(b)  and 

(c)  and 

(d)  and 

Column II (test to distinguish)

(p) Libermann nitroso test

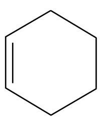
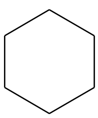
(q)  (Dye test)

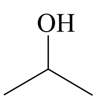
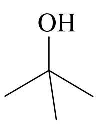
(r) Iodoform

(s) Lucas

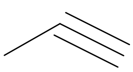
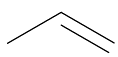
(t) $NaHSO_3$

35. Column I
(pair of compounds)

(a)  and 

(b)  and 

(c) $H-\overset{O}{\overset{||}{C}}-OH$ and $CH_3-\overset{O}{\overset{||}{C}}-OH$

(d)  and 

Column II
(identification test)

(p) Tollen's reagent test

(q) $Br_2 + H_2O$ test

(r) Lucas test

(s) Iodoform test

(t) Ammonical Cu_2Cl_2 test

36. Column I (reagents)

(a) Product of reaction of propyne with 1 per cent $HgSO_4$ and Dil. H_2SO_4

(b) Br_2 water test given by

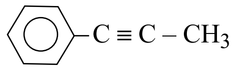
(c) Addition of HBr can be with

(d) Tollen's reagent give white ppt. with

Column II

(p) Me–CH=CH–Me

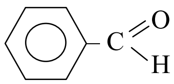
(q) Me–C≡C–H

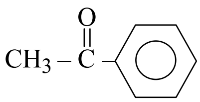
(r) 

(s) $Me-CH=CH_2$

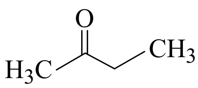
(t) $Me-\overset{O}{\overset{\|}{C}}-Me$

37. Column I (compound)

(a) 

(b) 

(c) $CH_3-\overset{O}{\overset{\|}{C}}-H$

(d) 

Column II (tests)

(p) 2,4-DNP test

(q) Yellow ppt. with NaOH + I_2

(r) Red ppt. with Fehling's solution

(s) Silver mirror with Tollen's reagent

38. Column I (reagents)

(a) Tollen's reagent give white ppt. with

(b) $Br_2 + H_2O$ test given by

(c) Product of reaction of acetylene with 1 per cent $HgSO_4$ and Dil. H_2SO_4

(d) Pd/H_2 reacts with

Column II

(p) Me–CH=CH–Me

(q) Me–C≡C–H

(r) $Cl\overset{\oplus}{N}H_3-NH_2$

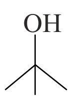
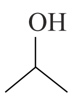
(s) $Me-\overset{O}{\overset{\|}{C}}-H$

(t) $Me-\overset{O}{\overset{\|}{C}}-Me$

39. Column I (pair of compounds)

(a) $Ph-\overset{O}{\overset{\|}{C}}-H$ and $Me-\overset{O}{\overset{\|}{C}}-H$

(b) $Me-\overset{O}{\overset{\|}{C}}-Me$ and $Me-\overset{O}{\overset{\|}{C}}-H$

(c)  and 

(d) $Me-C\equiv C-H$ and $Me-C\equiv C-Me$

Column II (test of identification)

(p) Tollen's reagent

(q) Fehling's reagent

(r) Iodoform test

(s) Victor Meyer's test

(t) Lucas test

Answer Keys

LEVEL 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
a	b	b	c	b	b	a	b	a	a	c	c	c	c	b
16	17	18	19	20	21	22	23	24	25	26	27	28	29	
b	ab	c	d	d	b	d	abc	c	abcd	c	b	c	b	

LEVEL 2

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
abc	ab	abd	abcd	abcd	bcd	abc	ac	abc	abcd	abc	ab	bc	bc	ab
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
a	a	b	a	d	c	b	d	bc	c	c	b	d	a	c
31	32	33	34(a)	34(b)	34(c)	34(d)	35(a)	35(b)	35(c)	35(d)	36(a)	36(b)	36(c)	36(d)
d	b	c	rs	pq	p	rt	q	rs	p	pt	t	pqrs	pqrs	q
37(a)	37(b)	37(c)	37(d)	38(a)	38(b)	38(c)	38(d)	39(a)	39(b)	39(c)	39(d)			
ps	pq	pqrs	pq	qr	pq	s	pqst	qr	pq	rst	p			

CHAPTER

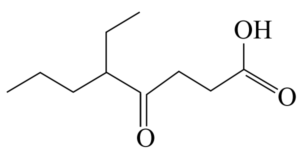
10

Nomenclature

Question Bank

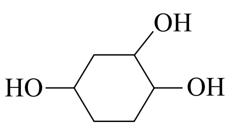
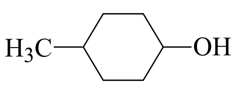
Single and Multiple-choice Type

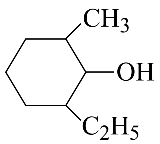
1. The IUPAC name of the compound shown here is

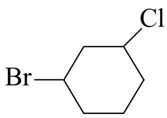


(a) 5-Ethyl-1-hydroxyoctan-1,4-dioic acid
(b) 2-Carboxyethyl-3-hexyl ketone
(c) 3-(3-Hexylcarbonyl) propanoic acid
(d) 5-Ethyl-4-ketooctanoic acid

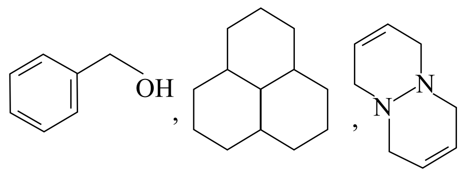
2. Which of the following compounds are not correctly matched?

Compound	IUPAC name
(a) 	Cyclohexane-1,2,4-triol
(b) 	4-Methylcyclohexanol

(c)  2-Ethyl-6-methylcyclohexanol

(d)  3-Bromo-1-chlorocyclohexane

3. The no. of secondary C-atoms present in the following compounds respectively is

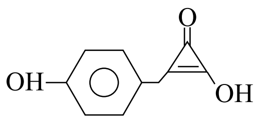


(a) 7, 9, 4 (b) 5, 12, 8 (c) 6, 9, 8 (d) 5, 9, 4

4. The organic compound (Cyclohex-3-enyl) 2-ethyl cyclobutanecarboxylate does not contains

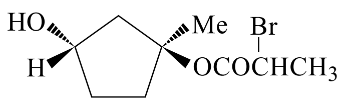
(a) two 3°-carbon atoms (b) two 1°-carbon atoms
(c) 9 secondary C-atoms (d) one 1°-carbon atoms

5. The IUPAC name of the compound given below is

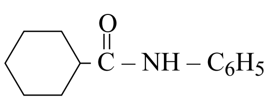


(a) 2-Hydroxy-3-(4′-hydroxyphenyl) cyloprop-2-en-1-one
(b) 2-Hydroxy-3-(4′-hydroxyphenylmethyl) cyloprop-2-en-1-one
(c) 4-(2′-Hydroxy-3′-oxocycloprop-1′-enylmethyl) phenol
(d) 4-(1′-Hydroxy-3′-oxocycloprop-1′-enylmethyl) phenol

6. The correct IUPAC name of the compound is

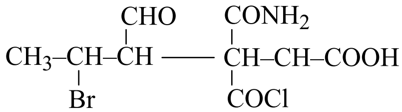


(a) 2-Bromopropyl-3-hydroxy-1-methylcyclopentane carboxylate
(b) 3′-Hydroxy-1′-methylcyclopentyl-2-bromopropanoate
(c) 1′-Hydroxy-3′-methylcyclopentyl-2-brompropanoate
(d) None of these

7. The IUPAC name of  is

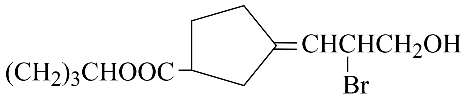
(a) N-Cyclohexylbenzamide
(b) N-Phenyl-N-cyclohexylmethanamide
(c) N-phenylcyclohexane carboxamide
(d) N-Cyclohexyl-N-phenylmethyl amide

8. The IUPAC name of the given compound is



(a) 2-Bromo-4-carbamoyl-5-chloroformyl-3-formylhexanoic acid
(b) 5-Bromo-3-carbamoyl-3-chloroformyl-4-formylhexanoic acid
(c) 4-Formyl-2-chloroformyl-3-carbamoyl-5-bromohexanoic acid
(d) 2-Chloroformyl-3-carbamoyl-4-formyl-5-bromohexanoic acid

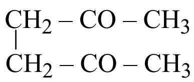
9. The correct IUPAC name of the compound given below is

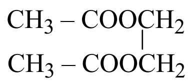


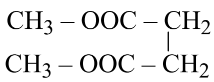
(a) 3-(3′-isopropoxycarbonyl cyclopentylidene) propan-1-ol
(b) 3-(2′-Bromo-3′-hydroxypropylidene) cyclopentanecarboxylate
(c) Isopropyl-3-(2′-bromo-3′-hydroxypropylidenyl) cyclopentanecarboxylate
(d) Isopropyl-3-(2′-bromo-3′-hydroxypropylidene) cyclopentanecarboxylate

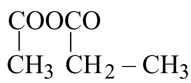
10. IUPAC name of isopentyl alcohol is
(a) 1-Hydroxy-2-methyl pentane
(b) 3-Methyl butan-1-ol
(c) 2-Methyl propanol
(d) 2-Methyl-2-butanol

11. Which of the following structure represent Dimethyl butanedioate?

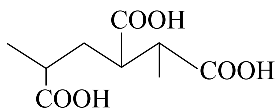
(a) 

(b) 

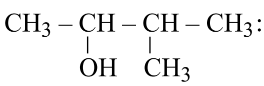
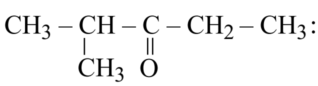
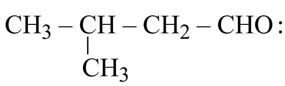
(c) 

(d) 

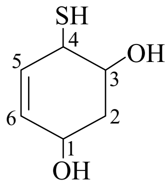
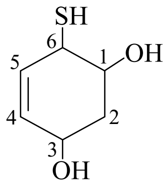
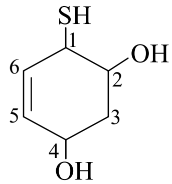
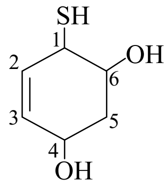
12. IUPAC name of the following compound is



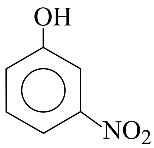
(a) 2-(1-carboxyethyl)-4-methyl pentanoic acid
(b) 3,5-Dicarboxy-2-methyl hexanoic acid
(c) 2,4,5-Hexane tricarboxylic acid
(d) 2,3,5-Hexane tricarboxylic acid

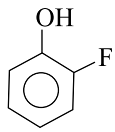
13. Which of the following compound has incorrect IUPAC nomenclature?
(a) $CH_3CH_2–CH_2–COOC_2H_5$: Ethyl butanoate
(b)  : 2-Methyl butan-3-ol
(c)  : 2-Methyl pentan-3-one
(d)  : 3-Methyl butanal

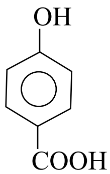
14. Select the structure with correct numbering for the IUPAC name of the given compound.

(a)  (b)  (c)  (d) 

15. In which of the following H-bonding is responsible for low volatility?

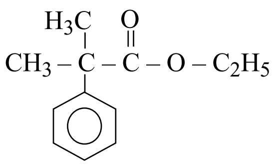
(a) 

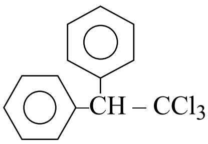
(b) 

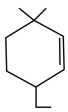
(c) 

(d) None of these

16. Which of the following is not correctly matched?

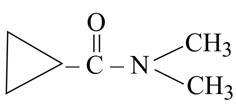
(a)  Ethyl-2-methyl-2-phenyl propanoate

(b)  1,1,1-Trichloro-2,2-diphenyl ethane

(c)  6-Ethyl-3,3-dimethyl cyclohex-1-ene

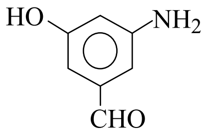
(d) $H_2N-\underset{|}{CH}(CN)-\underset{|}{CH}(CN)-CHO$ 2-Formyl-3-amino-1,4-butane dinitrile

17. IUPAC name of the following compound is

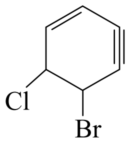


(a) N,N-Dimethyl cyclopropanamide
(b) N-Methyl cyclopropanamide
(c) N,N-Dimethyl cyclopropane carboxamide
(d) N,N-Dimethyl cyclopropolonamide

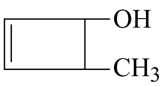
18. Correct IUPAC name of the given compound



(a) 5-amino-3-hydroxy benzene carbaldehyde
(b) 3-amino-5-formyl benzenol
(c) 3-amino-5-hydroxy benzaldehyde
(d) 3-formyl-5-hydroxy aniline

19. The IUPAC name of the given structure  is

(a) 5-Bromo-6-chloro cyclohex-1-en-3-yne
(b) 6-Bromo-5-chloro cyclohex-1-ene-3-yne
(c) 6-Bromo-5-chloro cyclohex-3-ene-1-yne
(d) 4-Bromo-3-chloro cyclohex-1-ene-5-yne

20. The IUPAC name of  is

(a) 3-Methyl cyclobut-1-ene-2-ol
(b) 2-Methyl cyclobut-3-ene-1-ol
(c) 4-Methyl cyclobut-1-ene-3-ol
(d) 4-Methyl cyclobut-2-en-1-ol

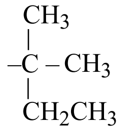
21. Correct name for $(C_2H_5)_2C = C(CH_3)CH_2CO_2H$
(a) 4, 4-Diethyl-3-methyl-3-butenoic acid
(b) 4-Ethyl-3-methyl-3-hexenoic acid
(c) 3-Ethyl-4-methyl-3-hexenoic acid
(d) 3-Ethyl-4-methyl-3-hexen-6-oic acid

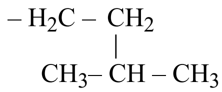
22. Which statement is incorrect in the following?
(a) Methyl acetate is the first higher homologue of methyl formate.
(b) Propanoic acid and propionic acid are identical.
(c) Vinyl alcohol is the lower homologue of propionaldehyde.
(d) $CH_3–NH–CH_2–CH_3$ is the lower homologue of $CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - NH - CH_3$.

23. Match the following

(a) $- \overset{\displaystyle CH_3}{\overset{|}{CH}} - \underset{\displaystyle CH_3}{\underset{|}{CH_2}}$ (i) Isobutyl

(b) $- CH_2 - \overset{\displaystyle CH_3}{\overset{|}{\underset{\displaystyle CH_3}{\underset{|}{CH}}}}$ (ii) Tert-pentyl

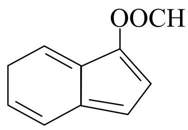
(c)  (iii) Isopentyl

(d)  (iv) Sec. butyl

(a) a - ii; b - iv; c - ii; d - iii
(b) a - iv; b - i; c - iii; d - ii
(c) a - iv; b - i; c - ii; d - iii
(d) a - iv; b - ii; c - i; d - iii

24. Number of C-atoms in first higher homologue of first member of ester family is
(a) 5 (b) 4 (c) 3 (d) 2

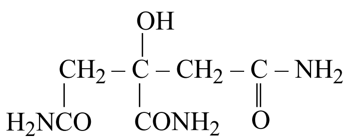
25. In a given compound if number of σ- and π-bonds are X and Y, respectively then (X + Y) will be



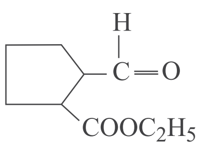
(a) 28 (b) 26 (c) 27 (d) 24

26. Which statement is correct in the following?
(a) Alicyclic compounds are acyclic compounds.
(b) In secondary amine, nitrogen is attached to 2° carbon atom.
(c) 1°, 2°, 3° amines are homologues of each other.
(d) $HCOOCH_3$ and CH_3COOH are not homologues of each other.

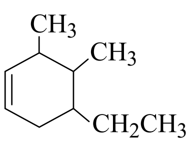
27. The correct systematic IUPAC name of the given compound is



(a) 3-Carbamoyl-3-hydroxybutanediamide
(b) 2-Hydroxypropane-1,2,3-tricarbamoyl
(c) 2-Hydroxypropane-1,2,3-tricarboxamide
(d) 2-Bis(carbamoyl)-2-hydroxyethanamide

28. The correct name for  is

(a) 2-Oxocyclopentanecarboxylate
(b) 2-Formylcyclopentanecarboxylate
(c) Ethyl-2-formylcyclopentanecarboxylate
(d) Ethyl-2-oxocyclopentanecarboxylate

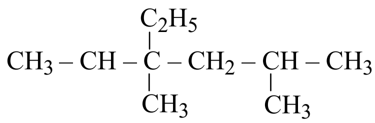
29. The IUPAC name of  is

(a) 2, 3-Methyl-1-ethylcyclohex-4-ene (b) 5-Ethyl-3, 4-dimethylcyclohex-1-ene
(c) 4-Ethyl-5, 6-dimethylcyclohex-1-ene (d) 1-Ethyl-2, 3-dimethylcyclohex-4-ene

30. Which of the following names is correct?
(a) 4, 4-Dimethyl-3-ethylpentane (b) 3-Methyl-4-oxobutanoic acid
(c) 1-Ethyl-2-methylpent-4-ene (d) Bicyclo[1.2.3]heptane

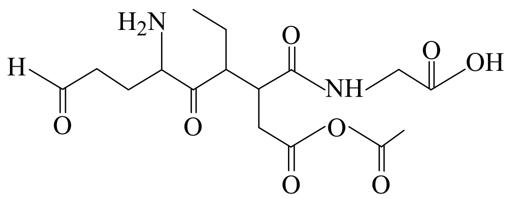
31. IUPAC name of the compound $OHC-CH_2-CH_2-\underset{|}{CH}(CH_2-CHO)-CH_2-CHO$ is
(a) 4, 4-Di (formylmethyl) butanal
(b) 2-(formylmethyl) butane-1, 4-dicarbaldehyde
(c) Hexane-3-acetal-1, 6-dial
(d) 3-(formylmethyl) hexanedial

32. The correct IUPAC name of the following compound is



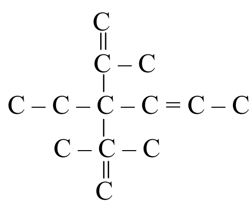
(a) 3-Ethyl-3,5,-dimethylhexane (b) 4-Ethyl-2,4,-dimethylhexane
(c) 2,4-Dimehtyl-4-ethylhexane (d) 4-Ethyl-2,4,-dimethylhexene

33. The number of functional groups present in the following compounds is



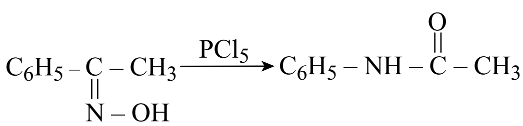
(a) 5 (b) 7 (c) 6 (d) 8

34. Write the IUPAC name of the following compound



(a) 3-(1,1-dimethylethenyl)-3-ethyl-2-methyl-1,4 hexadiene
(b) 3-ethyl-2-methyl-3-(1,1-dimethylethenyl)-1,4 hexadiene
(c) 3-ethyl-2-2-dimethyl-3-(1-methylethenyl)-1,4 hexadiene
(d) 3-ethyl-3-(1-methylethenyl)-2-2-dimethyl-1,4 hexadiene

35. Hybridization of which atom changes in the following reaction?



(a) C and O (b) C and N
(c) N and O (d) No change in the hybridization of any atom

36. $—\overset{\oplus}{\underset{a|}{C}}—\underset{\dot{b}}{\dot{C}}—\underset{c}{\ddot{C}}—\overset{-}{\underset{d|}{C}}—$; carbon atoms a, b, c and d are in

(a) sp^2, sp^3, sp^2 and sp^3 hybrid states respectively
(b) sp, sp^2, sp and sp^3 hybrid states respectively
(c) sp^2, sp, sp^2 and sp^3 hybrid states respectively
(d) sp^2, sp^2, sp^2 and sp^3 hybrid states respectively

37. Ratio of π- and σ-bonds in Ph–COOH will be
(a) 5:3 (b) 3:5 (c) 3:16 (d) 4:15

38. Which of the following compound has incorrect IUPAC nomenclature?

(a) $CH_3CH_2–CH_2–COOC_2H_5$: Ethyl butanoate

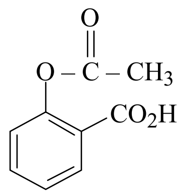
(b) $CH_3-\underset{OH}{\underset{|}{CH}}-\underset{CH_3}{\underset{|}{CH}}-CH_3$: 2-Methyl butan-3-ol

(c) $CH_3-\underset{CH_3}{\underset{|}{CH}}-\underset{O}{\underset{||}{C}}-CH_2-CH_3$: 2-Methyl pentan-3-one

(d) $CH_3-\underset{CH_3}{\underset{|}{CH}}-CH_2-CHO$: 3-Methyl butanal

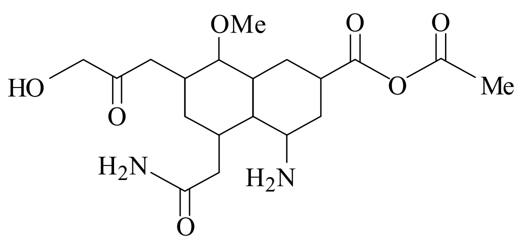
39. Identify incorrect matching in the following
(a) Allyl alcohol-Prop-2-en-1-ol (b) Vinyl alcohol-Ethenol
(c) Propargyl alcohol-But-3-yn-1-ol (d) Acrylaldehyde-2-Propenal

40. IUPAC name of the following compound



(a) Aspirin (b) 2-Acetyl benzoic acid
(c) Acetyl salicylic acid (d) 2-Acetoxy benzoic acid

41. How many functional groups are present in the given molecule?



(a) 4 (b) 5 (c) 6 (d) 7

42. What is the ratio of number of σ- and π-bonds in the molecule $\underset{\underset{O}{\|}}{HC} - CH_2CH_2 - COOH$?

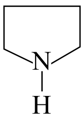
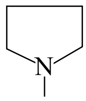
(a) 5 (b) 6 (c) 4 (d) none of these

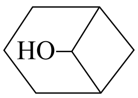
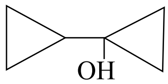
43. Which is not a first member of given homologous series?

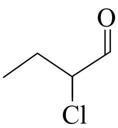
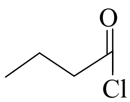
(a) Alkadiene $CH_2{=}C{=}CH_2$
(b) Alkenyne $HC{\equiv}C{-}CH{=}CH_2$
(c) Ethyl ester $CH_3CH_2 - O - \overset{\overset{O}{\|}}{C} - CH_3$
(d) Ketone $CH_3 - \overset{\overset{O}{\|}}{C} - CH_3$

44. Consider the given statements

(i) Acetone and acetaldehyde are homologues.

(ii)  is secondary amine while  is a tertiary amine.

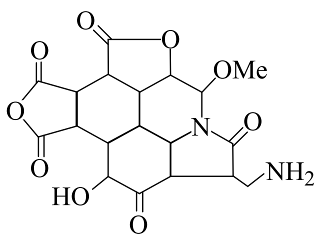
(iii)  is a secondary alcohol while  is a tertiary alcohol.

(iv)  and  both have different functional groups

Which is not incorrect?

(a) i, ii, iii (b) ii, iii, iv (c) i, ii, iv (d) i, iii, iv

45. Number of functional groups present in the given compound is

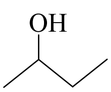


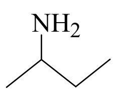
(a) 5 (b) 6 (c) 7 (d) 8

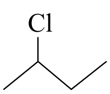
46. Which of the following compounds has isopropyl group?

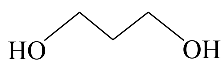
(a) 2,2,3,3-Tetramethyl pentane
(b) 2,2-Dimethyl pentane
(c) 2,2,3-Trimethyl pentane
(d) 2-Methyl pentane

47. What is the order of solubility in water of the following compounds?

(i) 

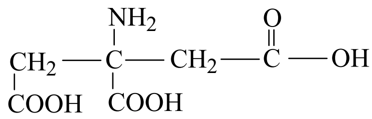
(ii) 

(iii) 

(iv) 

(a) i > ii > iii > iv
(b) iii > iv > i > ii
(c) iv > i > iii > ii
(d) iv > i > ii > iii

48. The correct IUPAC name of the given compound is



(a) 3-Carboxy-3-hydroxy butane dioic acid
(b) 2-Amino propane-1,2,3-tricarboxylic acid
(c) 3-Amino butanedioic acid
(d) 2-Bis(carboxymethyl)-2-hydroxy ethanoic acid

49. Total number of isomers of group C_5H_{11} is
(a) 5 (b) 3 (c) 8 (d) 9

50. Write the correct name from the incorrect name 2,3-, dichloro-2,4-dibromohept-4-ene
(a) 2, 4-dibromo-2,3-dichloro hept-4-ene
(b) 4, 6-dibromo-5,6-dichloro hept-3-ene
(c) 4, 6-dibromo-5,6-dichloro hept-4-ene
(d) 5, 6-dichloro-4,6-dibromo hept-3-ene

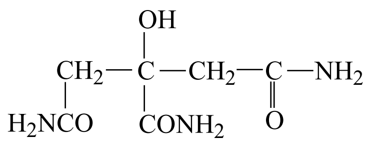
51. In IUPAC nomenclature of compounds

(i) $-\overset{\overset{\large O}{\|}}{C}-NH_2$ (ii) $-\overset{\overset{\large O}{\|}}{C}-OH$ (iii) $-\overset{\overset{\large O}{\|}}{C}-Cl$

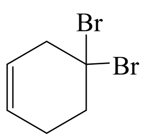
(iv) $-\overset{\overset{\large O}{\|}}{C}-H$ (v) $-C\equiv N$

The priority order of group is/are
(a) ii > i > iii > iv > v (b) ii > iii > i > v > iv
(c) ii > iii > v > i > iv (d) ii > iii > i > iv > v

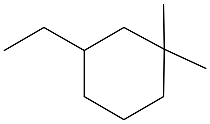
52. The correct systematic IUPAC name of the given compound is



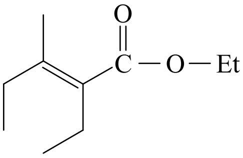
(a) 3-Carbamoyl-3-hydroxybutanediamide
(b) 2-Hydroxypropane-1,2,3-tricarbamoyl
(c) 2-Hydroxypropane-1,2,3-tricarboxamide
(d) 2-Bis(carbamoyl)-2-hydroxyethanamide

53. 

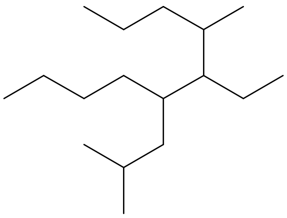
(a) trans-1,1-dibromocyclohexene
(b) 1,1-dibromocyclohex-3-ene
(c) 3,3-dibromocyclohexene
(d) 4,4-dibromocyclohexene

54. 

(a) 1-Ethyl-3,3-dimethylcyclohexane
(b) 3,3-Dimethyl-1-ethylcyclohexane
(c) 3-Ethyl-1,1-dimethylcyclohexane
(d) 1,1-Dimethyl-3-ethylcyclohexane

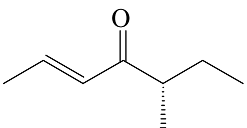
55. 

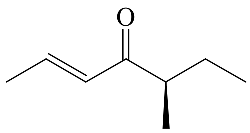
(a) ethyl 2-ethyl-3-methyl-2-butenoate
(b) O,2-diethyl-3-methyl-2-butenaote
(c) 1-ethoxy-2-ethyl-3-methyl-2-butenal
(d) 2-methyl-2-pentenyl propanaote

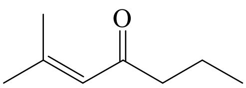
56. 

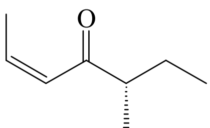
(a) 4-Isobutyl-3-pentyloctane
(b) 5-Ethyl-4-methyl-6-(2-methylpropyl)decane
(c) 6-Ethyl-7-methyl-5-(methylpropyl)decane
(d) 4-Butyl-5-ethyl-2,6-dimethylnonane

57. (2E, 5R)-5-methylhept-2-en-4-one

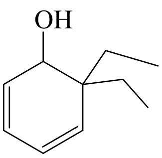
(a) 

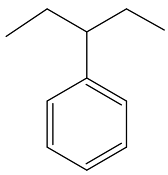
(b) 

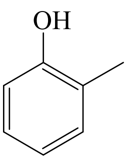
(c) 

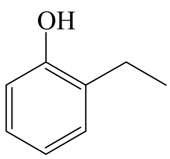
(d) 

58. 2-Ethylphenol

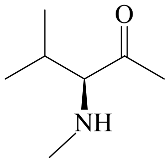
(a) 

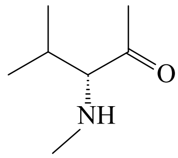
(b) 

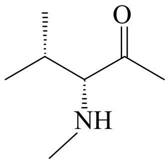
(c) 

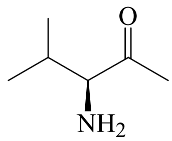
(d) 

59. (S)-(N,4)-dimethyl-3-aminopentan-2-one

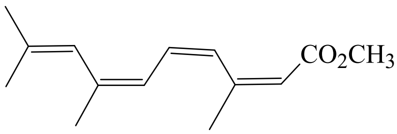
(a) 

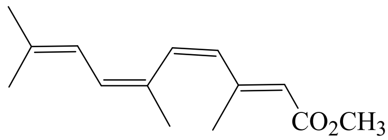
(b) 

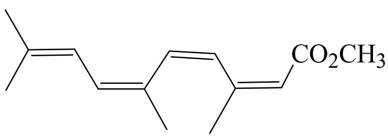
(c) 

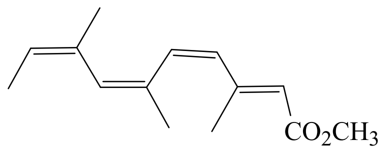
(d) 

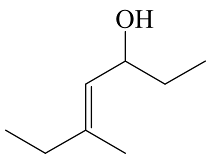
60. Methyl (2Z,4Z,6Z)-3,6,9-trimethyl-2,4,6,8-decatetraenoate

(a) 

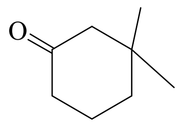
(b) 

(c) 

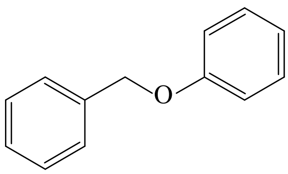
(d) 

61. 

(a) (E)-5-methyl-3-heptanal
(b) (Z)-3-methyl-3-hepten-5-al
(c) (E)-5-methyl-4-hepten-3-ol
(d) (Z)-5-methyl-4-hepten-3-ol

62. 

(a) 5,5-Dimethylcyclohexanol
(b) 3,3-Dimethylcyclohexanone
(c) 1,1-Dimethylcyclohexanone
(d) 3,3-Dimethylcyclohexanal

63. 

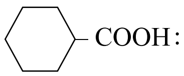
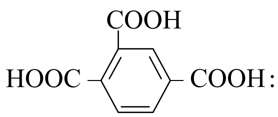
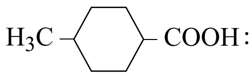
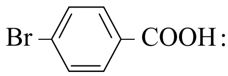
(a) Dibenzyl ether
(b) Benzyl phenyl ether
(c) Benzyl phenyl ester
(d) 3,3-Dibromocyclohexene

64. Which name is correct for the following compound?

$$CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-C\equiv N$$

(a) 2-Methyl propanenitrile (b) Isobutyl cyanide
(c) Isobutyronitrile (d) Isopropyl cyanide

65. IUPAC name of which of the following compounds is correct?

Compound	IUPAC name
(a) 	Cyclohexanoic acid
(b) 	1,2,4-Benzene tricarboxylic acid
(c) 	4-Methyl cyclohexane carboxylic acid
(d) 	4-Bromobenzoic acid

66. Name(s) of $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CN$ is/are

(a) Isopropyl cyanide (b) Sec-propyl cyanide
(c) Isobutyro nitrile (d) 2-methyl propane nitrile

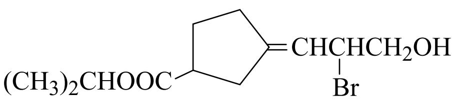
67. In Lassaigne's test, the organic compound is at first fused with sodium metal. The sodium metal is used because
(a) The melting point of sodium is low; so, it is easily fused with organic substances.
(b) Sodium is very much effective to bring about destructive reductions of organic compounds forming ionic inorganic salts such as NaCN, Na_2S and NaX.
(c) All sodium salts are soluble in water.
(d) None of these.

68. Chromatographic technique can be used for separation of
(a) Volatile solids (b) Amino acids (c) Plant pigments (d) Sugars

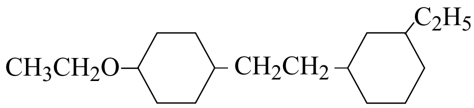
Comprehension Type

Passage 1

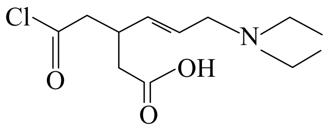
The IUPAC has set guidelines for logical and methodical naming of organic compounds. The complex substituents are written in brackets and their numbering is done separately. The bivalent radicals are named by adding 'idene' to the name of alkyl group. In polyfunctional compounds, all lower priority groups are written as a prefix. Now, name the following compounds.

69.  is

(a) 3-(3′-isopropoxycarbonyl cyclopentylidene) propane-1-ol
(b) 3-(2′-bromo-3′-hydroxypropylidene) cyclopentane carboxylate
(c) Iso-propyl-3-(2′-bromo-3′-hydroxypropylidenyl) cyclopentane carboxylate
(d) Iso-propyl-3-(2′-bromo-3′-hydroxypropylidene) cyclopentane carboxylate

70.  is

(a) 2-(3′-Ethylcyclohexyl)-1-(4′-ethoxycyclohexyl) ethane
(b) 1-Ethyl-3-(2′-(4″-ethoxycyclohexyl) ethyl) benzene
(c) 1-(3′-Ethylcyclohexyl)-2-(4′-ethoxycyclohexyl) ethane
(d) None of these

71.  is

(a) 3-Chlorocarbonyl-6-(N,N-diethylamino) hex-4-ene-1-oic acid
(b) 4-Chlorocarbonyl-3-(N,N-diethylamino) butanoic acid
(c) 3-Chlorocarbonyl-3-(3-N,N-diethylamino prop-1′-enyl) butane-1-oic acid
(d) 3-Chlorocarbonyl methyl-6-(N,N-diethylamino) hex-4-en-1-oic acid

Passage 2

Rules for IUPAC nomenclature of compounds containing one functional group, multiple bonds and substituents are given hereunder.

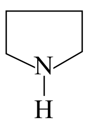
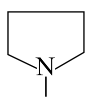
(a) Select the longest possible chain of carbon atoms containing the functional group and the maximum number of multiple bonds as the parent chain without caring whether it also denotes the longest possible carbon chain or not.
(b) After selecting the parent chain, the numbering should be done in such a way that it gives lower possible number the functional group.
(c) When a chain containing functional groups such as –CHO, –COOH, COOR, –COCl, etc. is present, it is always given number 1 and number 1 is usually omitted from the final name of the compound.
(d) If the organic compound contains a functional group, multiple bond, side chain or substituent, the following order of preference should be followed.

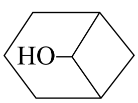
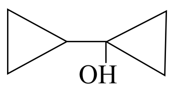
Functional group > Double bond > Triple bond > Substituent

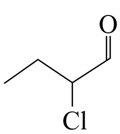
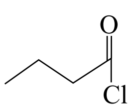
(e) If a compound contains two or more like groups, the numerical prefixes di, tri, tetra, etc. are used and terminal 'e' from the primary suffix is retained.

On the basis of the above rules, give answers for the following questions:

72. Consider the given statements
(i) Acetone and acetaldehyde are homologues.

(ii)  is a secondary amine while  is a tertiary amine.

(iii)  is a secondary alcohol while  is a tertiary alcohol.

(iv)  and  both have different functional groups.

Which is not incorrect?

(a) i, ii, iii (b) ii, iii, iv

(c) i, ii, iv (d) i, iii, iv

73. Correct IUPAC name from the incorrect name 4-amino-3-hydroxy-2-butene is

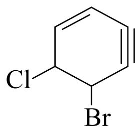
(a) 1-Amino-2-hydroxy-2-butene

(b) 4-Amino-2-buten-3-ol

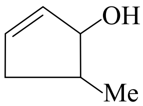
(c) 1-Amino-2-buten-2-ol

(d) 1-Amino-2-butenol

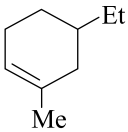
74. Which of the following has incorrect IUPAC name?

(a) 

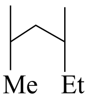
5-Bromo-6-chloro cyclohex-1-en-3-yne

(b) 

2-Methyl cyclopent-4-en-1-ol

(c) 

5-Ethyl-1-methyl cyclohexene

(d) 

2,4-Dimethyl hexane

Passage 3

Rules for IUPAC nomenclature of compounds containing one functional group, multiple bonds and substituents are given hereunder.

(a) Select the longest possible chain of carbon atoms containing the functional group and the maximum number of multiple bonds as the parent chain without caring whether it also denotes the longest possible carbon chain or not.

(b) After selecting the parent chain, the numbering should be done in such a way that it gives lower possible number for the functional group.

(c) When a chain containing functional groups such as –CHO, –COOH, COOR, –COCl, etc. is present, it is always given number 1 and number 1 is usually omitted from the final name of the compound.

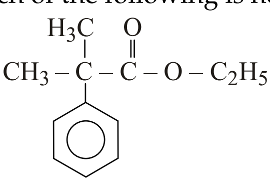
(d) If the organic compound contains a functional group, multiple bond, side chain or substituent, the following order of preference should be followed.

Functional group > Multiple bond > Substituent

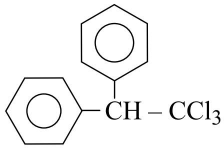
(e) If a compound contains two or more like groups, the numerical prefixes di, tri, tetra, etc. are used and terminal 'e' from the primary suffix is retained.

On the basis of the above rules, give answers for the following questions:

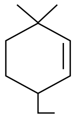
75. Which of the following is not correctly matched?

(a) 

Ethyl-2-methyl-2-phenyl propanoate

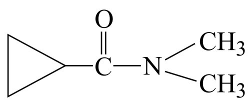
(b) 

1,1,1-Trichloro-2,2-diphenyl ethane

(c) 
6-Ethyl-3,3-dimethyl cyclohex-1-ene

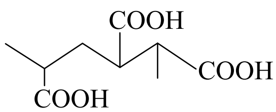
(d) $H_2N-\underset{\displaystyle CN}{\underset{|}{CH}}-\underset{\displaystyle CN}{\underset{|}{CH}}-CHO$ 2-Formyl-3-amino-1,4-butane dinitrile

76. IUPAC name of the following compound is



(a) N,N-Dimethyl cyclopropanamide
(b) N-Methyl cyclopropanamide
(c) N,N-Dimethyl cyclopropane carboxamide
(d) N,N-Dimethyl cyclopropolonamide

77. IUPAC name of the following compound is



(a) 2-(1-carboxyethyl)-4-methyl pentanoic acid
(b) 3,5-Dicarboxy-2-methyl hexanoic acid
(c) 2,4,5-Hexane tricarboxylic acid
(d) 2,3,5-Hexane tricarboxylic acid

Passage 4

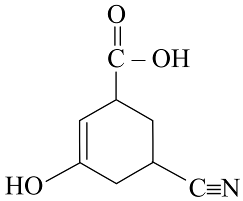
IUPAC system is the most rational and widely used system of nomenclature in organic chemistry. Any given molecule has only one IUPAC name and any given IUPAC name denotes only one molecular structure. Numbering the principal chain order is principal functional group > multiple bond > substituents.

78. IUPAC name of

$$CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-\underset{\displaystyle CN}{\underset{|}{CH}}-CH_3$$

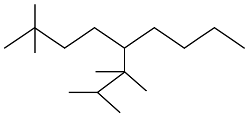
(a) 2-Cyano-4-methylpentane
(b) 2-Methyl-4-cyanopentane
(c) 2,4-Dimethyl pentane nitrile
(d) 2-Dimethyl-4-cyanopentane

79. The IUPAC name of the following compound is



(a) 4-Hydroxy-3-cyano cyclohex-5-ene carboxylic acid
(b) 3-Hydroxy-5-cyano cyclohex-5-enoic acid
(c) 5-Cyano-3-hydroxy cyclohex-2-ene carboxylic acid
(d) 3-Carboxy-5-hydroxycyclohex-5-ene carbonitrile

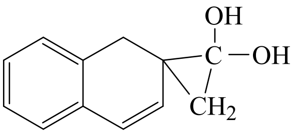
80. The correct IUPAC name of the following compound is

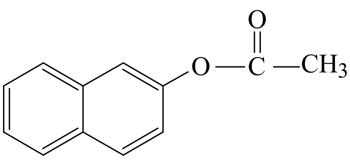


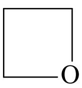
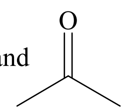
(a) 5-(1′,1′2′-trimethyl propyl)-2-2-dimethyl nonane
(b) 4-Butyl-2,3,3,7,7-pentamethylnonane
(c) 2,3,3,7, 7-Pentamethyl-4-butyloctane
(d) 2,2-Dimethyl-5-(1′,1′,2′ trimethylpropyl)nonane

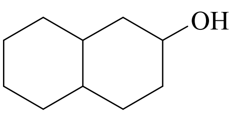
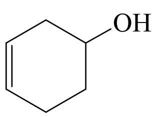
Matrix Type

81. Column I

(a)  and



(b)  and 

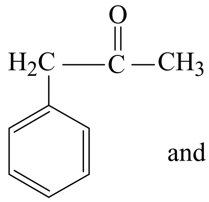
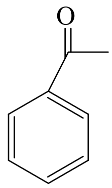
(c)  

Column II

(p) Functional groups are same pair of compound

(q) DBE is same

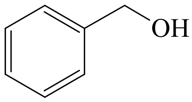
(r) Functional groups are different in pair of compound

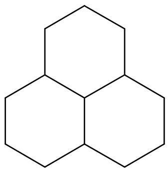
(d)  and 

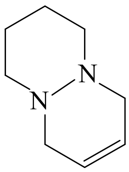
(s) Even number of 2° carbon 'C' atom present in both compounds

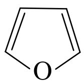
(t) Odd number of 2° 'C' atom present in pair of compound in both compounds

82. Column I **Column II**

(a)  (p) Odd number of 3° 'C'

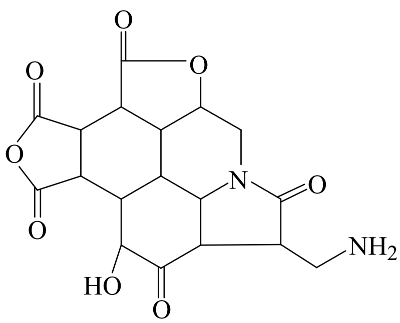
(b)  (q) Odd DBE (double bond equivalents)

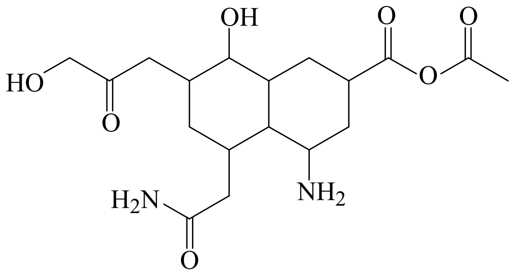
(c)  (r) Even DBE (double bond equivalents)

(d)  (s) Heterocyclic ring is present

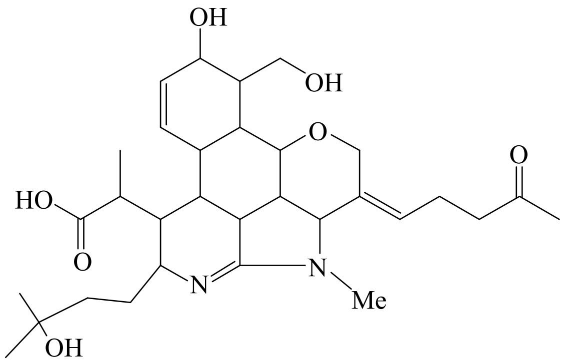
(t) Even number of 2° 'C' atom

83. Column I **Column II**

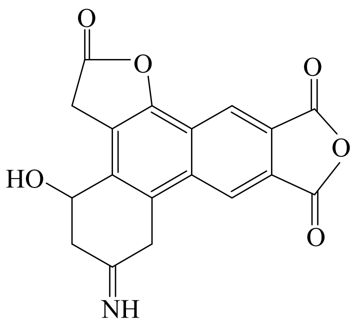
(a)  (p) DU/DBE is odd

(b) 

(q) DBE/DU is even

(c) 

(r) Functional groups are odd

(d) 

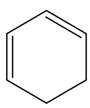
(s) Functional groups are even

(t) Number of 2° 'C' even

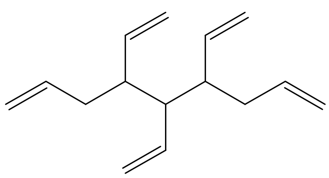
(u) Loctore is present as functioanl group

84. Column I

(a) Cyclohexa-1, 3-diene



(b) 4, 5, 6-Triethenlnona-1, 8-diene



(c) Cyclo octa-1, 3, 5-triene

(d) 1, 3, 5-trimethyl benzene

Column II

(p) DU is odd

(q) DU is even

(r) Compound has 1 : 1 : 1 ratio for 1°, 2° and 3° 'C' atoms

(s) Unsaturated compound

Answer Keys

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
d	d	d	b	b	b	c	b	d	b	c	d	b	b	c
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
d	c	c	a	d	b	c	c	c	c	d	c	c	b	b
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
d	b	c	d	d	c	d	b	c	d	c	b	c	b	c
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
d	d	b	c	b	b	c	d	c	a	b	b	d	a	c
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
c	b	b	acd	bcd	abcd	abc	b	d	d	d	b	c	b	d
76	77	78	79	80	81(a)	81(b)	81(c)	81(d)	82(a)	82(b)	82(c)	82(d)	83(a)	83(b)
c	d	c	b	a	r	qrt	pqs	pq	pr	q	qst	qst	pstu	qrt
83(c)	83(d)	84(a)	84(b)	84(c)	85(d)									
qst	qstu	ps	ps	qs	qrs									